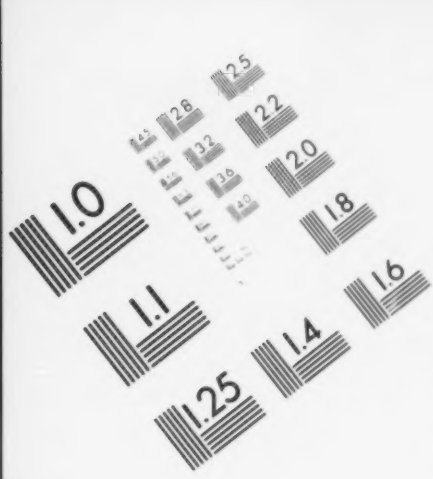

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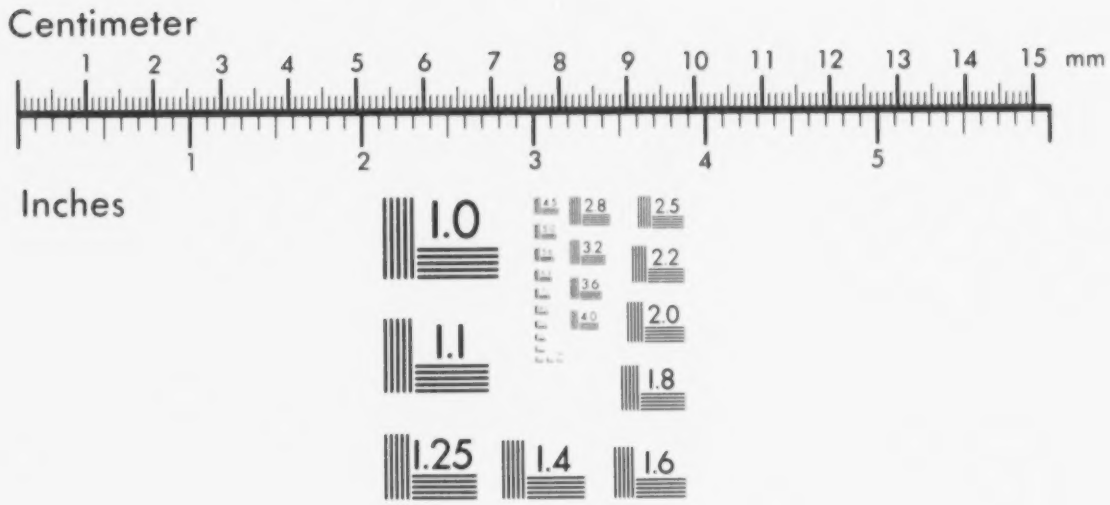

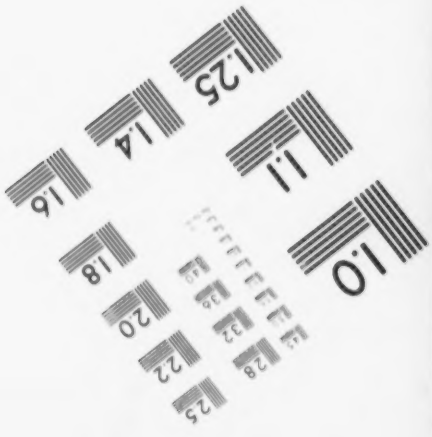

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ABSTRACT

In countries where young people have been relatively successful in both achieving high academic standards and making smooth transitions to employment, employers have taken major responsibility for their training. Now the emergence of a more "learning-intensive" economy poses new challenges. In response to the perceived insufficiency of traditional education and training to prepare young people for more learning-intensive work, recent policies in many industrialized countries are converging on four principles. The first and most fundamental principle from the perspective of U.S. policy (because it affects how the others are implemented) is that new curricula should be created that integrate vocational and academic studies. The second principle is that occupational and educational performance standards should be explicitly related to each other. Formal standards and certification procedures that specify what individuals should know and be able to do are important elements of a school-to-work system. Because one hallmark of the emerging economy is the necessity for continual learning in the context of work, the third principle is that schools should give all students some experience in work-based learning. The fourth principle is that employers and educators, including both vocational and academic educators, must share both responsibility and power in new school-to-work systems. (Appendixes contain 97 references and 4 figures.) (YLB)

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SCHOOL-TO-WORK POLICY INSIGHTS FROM RECENT INTERNATIONAL DEVELOPMENTS

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EXECUTIVE SUMMARY

In countries where young people have been relatively successful in both achieving high academic standards and making smooth transitions to employment—notably, Germany and Japan—employers have taken major responsibility for their training. German employers play a lead role in the famous "dual system." Japanese employers provide extensive training to recent school graduates after hiring them. Policymakers in other countries have therefore been attempting to emulate this success by increasing employer involvement in the training of young people.

Now the emergence of a more "learning-intensive" economy poses new challenges, both for countries with hitherto successful systems and for others. Employment is becoming increasingly fluid, occupational boundaries are changing or dissolving, and more jobs are temporary. Continual learning is a more important part of work, both because some organizations are giving more responsibility to front line staff for solving problems and improving procedures, and because more people are obliged to move from one employer to another. Organizations are seeking to promote learning and at the same time contain the cost of training through "on-line learning" strategies such as cross training within work teams, job rotation, and skill-based pay.

Traditional forms of education do not provide the best preparation for this emerging economy. Vocational education has tended to become too focused on specific skills and occupations that are likely to change in the future. Traditional academic education by itself is also inadequate because it does not equip students to apply their abstract knowledge or to learn in the context of practical problem solving. In response to the perceived insufficiency of traditional education and training to prepare young people for more learning-intensive work, recent policies in many industrialized countries are converging on four principles[1]:

1. New curricula should be created that integrate vocational and academic studies.

[1] In this paper, "academic" refers to a program of study that is primarily intended to prepare students for higher levels of formal education, and "vocational" refers to a program of study that is mainly intended to prepare students for work. Ordinarily, traditional academic courses are more abstract and theoretical, while traditional vocational courses are more concrete and applied. However, as will be noted, some traditional vocational programs in fact may include more theoretical and abstract subject matter than some academic programs.

2. Occupational and educational performance standards should be explicitly related to each other.

3. To prepare for learning-intensive work, initial education and training should include a certain amount of work-based learning for all students.

4. Employers and educators, including both vocational and academic educators, must share both responsibility and power in new school-to-work systems.

The first principle is the most fundamental from the perspective of U.S. policy because it affects how the others are implemented. Work-based learning, performance standards, and school-business partnerships often occur in countries that maintain strict separation between occupational training and academic education. These practices, by themselves, will not achieve the integration of vocational and academic education that is now being recognized as desirable in most countries.

To prepare individuals for work that demands autonomy and continual learning, many employers now call for education that promotes high-level thinking skills for all students, not just for the elite as in the past. Vocational education, which in many countries traditionally has offered practical training for students who were considered to possess relatively low academic ability, is now being reformed and in some places radically reconstituted. Reforms include strengthening the academic content of vocational preparation, as in the program of study for the French vocational secondary diploma instituted in 1986. In Germany, where many apprentices have traditionally received a high level of theoretical instruction as part of their training, there have been efforts in recent years to bolster the academic content even more. Countries are also making it easier for vocational graduates to pursue further studies at the university level, as in Germany, where 30% of university students in 1994 had completed apprenticeships in the dual system. These changes are intended to attract larger numbers of intellectually talented students into vocational programs, to give them sufficient theoretical grounding to deal with changing technology, and to prepare them for continual problem solving.

As change proceeds in this direction, the line between vocational and academic education becomes less distinct. Instead of serving as an alternative to general education, vocational education becomes a method for promoting it. For example, in 1991, Britain

began developing General National Vocational Qualifications, which enable students to qualify for the university through courses of study that focus on broadly defined industries. In 1994, Japan started offering a new "integrated course" that permits high school students to design individual study sequences preparing them for both careers and higher education. These initiatives to start blending vocational and academic education mirror the increased merging of production and learning in the workplace.

Formal standards and certification procedures, which specify what individuals should know and be able to do, are important elements of a school-to-work system. Many countries are now re-examining their standards or establishing new ones. Countries with well-established occupational training systems have been reducing the numbers of specific occupations to promote workers' flexibility, and including more generic work skills. But occupational and academic standards have usually been defined separately. These changes in occupational criteria can be carried out without bridging the separation between vocational and academic streams. For example, in Germany, where approximately two-thirds of the youth population participates in apprenticeships, the reform of vocational standards affects most young people but does not entail changes in the academic curriculum of upper secondary schools (*Gymnasien*) geared to university preparation.

Other countries are trying to develop vocational credentials that can serve as a step to university and other forms of higher education. England and Scotland have made some progress in this regard. The Netherlands and Denmark have developed vocational routes to higher education. Growing numbers of young Germans who graduate from academic high schools are completing apprenticeships before going on to universities, and the theoretical preparation of German apprentices is becoming even more rigorous. Countries that are following this path sometimes invoke the goal of achieving "parity of esteem" between vocational and academic education. No country has yet developed a unified secondary school structure based on one set of credentials for both vocational and academic studies, but current reform plans in Scotland call for an integration of many previously separate vocational and academic programs while still maintaining separate vocational credentials for many students. The state of Victoria in Australia has achieved a relatively complete integration of the formerly separate vocational and academic secondary school systems, including new curriculum and assessment methods (Raizen, Sellwood, Todd, & Vickers, 1995).

Because one hallmark of the emerging economy is the necessity for continual learning in the context of work, a logical implication for initial education and training is that schools should give young people some experience in **work-based learning**. By gaining practice in the deliberate use of work to develop knowledge and skill, young people should be better prepared for a lifetime of on-line learning at work. There is some evidence from France that this is so. Two basic strategies for work-based learning are classic apprenticeship and school-supervised work experience. In a classic apprenticeship, trainees have some of the rights and benefits of regular employees as well as some special entitlements. The German dual system is the biggest example of this kind. Several countries, including Britain, the Netherlands, and Spain, have recently created new apprenticeship systems or expanded existing ones. The same countries and others, including France, Korea, and Sweden, have also taken major new initiatives to expand work-based learning for students who are still under school supervision.

While some students in lower secondary or middle school participate in school-supervised work experience that is broad-based and exploratory, most of the newly created work-based learning is for upper secondary students and is still tied to vocational education with no connection to academic subjects. Unlike some incipient efforts in the United States, most of the new initiatives in other countries do not attempt to combine work-based learning with an integrated curriculum designed both to prepare young people for work and to maintain their option of enrolling in a university or other selective institution of higher education.

One form of school-supervised work experience is school-based enterprise, which engages students in production of goods or services for other people as part of a class or related school activity. Denmark recently has expanded the use of school-based enterprise in vocational education to supplement the number of training places available in outside firms. Some German apprentices spend a portion of their time in school-based enterprises within enterprise-based schools. Like other forms of school-supervised work experience, school-based enterprises both in other countries and in the United States have mainly been part of vocational education, although a British initiative in the 1980s promoted mini-enterprises within the general academic curriculum.

Development of work-based learning and links between occupational and academic skill standards call for **increased sharing of power and responsibility between**

educators and employers. In countries where schools still carry the main responsibility for education and training, the role of employers has increased. For example, in recent years, employers have taken a more active part in the governance of work-related education and training in Australia, Britain, and France. However, both in these countries and in Germany, where employers traditionally have had a major say, the employers' participation in governance has been limited to vocational education. Employers still exert little influence on the curriculum of secondary schools or programs whose primary mission is to prepare students for selective institutions of higher education.[2]

This report concludes that industrialized countries in Europe, Asia, and Australia are pursuing reforms similar to those under way in many American communities: overcoming traditional distinctions between vocational and academic curricula, and combining the two with work-based learning in an integrated course of study that prepares students both for careers and for college or university. Since every country has its own unique set of institutions, the reforms take a different shape in each context. Some countries are just beginning to move in this direction; others are continuing a process begun decades ago. In spite of the differences, the fact that most industrialized countries have now decided to undertake similar changes suggests that the reasons for them are strong and pervasive.

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[2] With respect to Germany, however, Jeff King has written to us that "there is a strong *de facto* influence on academics by employers of the most fundamental kind: they *teach* college level academics *in* the firm. U.S. college-level academics are taught, in firms, by firms. That is influence: academics are 'owned' not just by schools and universities; they are also the province of firms—and schools and universities know and respect that. There are all manner of shared educational and policy institutions protecting and encouraging this arrangement. Employers, through their technical education committees are . . . part of the national committees for education curricular frameworks bearing on the foundational academics for most youth and most occupations (all but graduate level university professional fields). They explicitly review and help structure curricular content in academic foundations, at levels comparable to U.S. college levels, in coordinating what elements are taught in schools and what are taught or reviewed in firm classrooms. Thus, they help shape academic curricular content, along with education policy people, at state and national levels. Hence: *They validate academics at all levels, create a market for it, keep pressure on schools to maintain highest standards in it, and tie it to applications and work-life contexts on a continuing basis, proving its value in concrete ways to students, families, and the larger society*. This is a very powerful influence."

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POLICY IMPLICATIONS OF PAST SUCCESSES AND CURRENT TRENDS

Lessons from Successful School-to-Work Systems

A successful school-to-work system would equip all young people with high levels of academic and occupational knowledge and skill, and would enable them to find employment that uses their capacities. By this definition, the OECD (Organisation for Economic Co-operation and Development) countries with the most successful systems in recent years have been Germany, Switzerland, Austria, and Japan. In these countries, students score relatively well on international tests in academic subjects (OECD, 1995a) and unemployment rates among 15- to 24-year-olds are relatively low (OECD, 1995b).

In each country with a successful school-to-work system, employers take major responsibility for training. German, Swiss, and Austrian employers hire and train apprentices in the well-known dual system. Japanese employers maintain long-lasting relations with schools, and provide extensive in-company training to newly hired graduates. Students in all these countries have a clear incentive to perform well in their academic studies because they are more likely to get good jobs if they earn good grades in school (Rosenbaum & Kariya, 1991; Soskice, 1994). The successful systems, especially those in Europe, also depend on widely recognized systems of skill standards and certification.

Public authorities in countries with less successful systems have been trying to emulate successful countries by involving employers more closely in the education and training of young people. The 1994 School-to-Work Opportunities Act in the United States was intended to stimulate the introduction of work-based learning on a large scale in American high schools. The Goals 2000: Educate America Act created a National Skill Standards Board to develop and oversee a system of voluntary industry-based skill standards. Similar initiatives have recently been taken or are currently under way in Australia, Britain, Denmark, France, Korea[3], Spain, Sweden, and elsewhere. These

[3] The situation in Korea, which was invited in 1996 to join the OECD, differs from the others. The Korean system has been successful on the criteria of high academic performance and low unemployment. However, in recent years, some university graduates have not been able to find immediate employment—an unprecedented problem in Korea—and this has caused concern that too many students are choosing secondary school programs that lead to university instead of work. In an attempt to increase the

measures, described in a later section, have been prompted mainly by the hope that stronger employer involvement, closer ties between schools and the workplace, and more effective systems of skill standards and certification can improve the performance of young people in school and work.

Generally, the youth unemployment rate varies with the rate of unemployment among adults. Figures 1-4 in the appendices display unemployment rates in OECD countries for 1979, 1983, 1990, and 1993.[4] Unemployment rates for adults between the ages of 25 and 54 are plotted on the horizontal axis, and rates for youth between the ages of 15 and 25 are measured on the vertical axis. For most countries, unemployment rates for both age groups were higher in 1983 and 1993 than in 1979 and 1990. In each year, countries with higher unemployment among adults tended also to have higher unemployment among young people. The straight line in each figure is the ordinary least squares regression line showing the average relationship between youth and adult unemployment rates. Most countries lie fairly close to the line, indicating that the adult unemployment rate is usually a good predictor of the youth unemployment rate. The simple correlation between youth and adult unemployment ranges from 0.53 in 1979 to 0.82 in 1993. This means that whatever set of conditions and policies cause a country to have relatively low or high adult unemployment also tend to cause youth unemployment to be relatively low or high, compared to other countries.

Using youth unemployment as a criterion, the U.S. school-to-work transition system is not the worst in the industrialized world, as has sometimes been alleged. That distinction should instead be given to the Mediterranean countries: Italy, Spain, Greece, and to a lesser extent France. Unemployment rates in the United States tend to be near the average for OECD countries, or slightly below it. The U.S. data in Figures 1-4 lie very close to the regression lines, indicating that youth unemployment tends to be almost exactly what would be predicted on the basis of adult unemployment.

Other comparative data (OECD, 1996) indicate that in recent years the U.S. school-to-work system actually appeared to be relatively effective. Long-term unemployment among 15- to 19-year-old males in 1994 was lower in the U.S. than in any other OECD

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attractiveness of vocational education, the Korean government has been promoting a "2 + 1" program under which students in vocational and technical high schools spend their entire third year at the workplace.

[4] The data is from OECD, 1995b, Statistical Annex Table B.

country for which data is available. For 15- to 19-year-old females, only Sweden had a lower rate than the U.S. (Table 4.4). Similarly, among a set of 21 OECD countries, the U.S. employment-to-population ratio for 20- to 24-year olds was also near the top: 74.6% for males and 64.5% for females (Table 4.2). In particular, this compared favorably with Germany where the employment rate was 67.7% and 65.7% for males and females, respectively. These figures reflect the robustness of the U.S. economy in 1994 compared to other industrialized countries.

It is important to note some of the limitations of the unemployment rate as a measure of labor market success. The unemployment rate is the number of individuals who do not have paid work and are actively seeking it, divided by the number in the active labor force, which comprises the employed plus the unemployed. "Discouraged workers," who are not employed but not actively seeking work, are not counted in the active labor force. Neither are incarcerated individuals—a relatively large group in the United States—nor secondary school graduates who failed university entrance examinations and are studying to take them again—a relatively large group in Japan, France, and the United Kingdom. The employment-to-population ratio, which includes the entire population in the denominator, makes no attempt to separate job seekers from nonseekers, but this is not necessarily a more valid measure. Furthermore, none of the employment or unemployment rates says anything about the quality of jobs that people hold.

Notwithstanding these limitations, Figures 1-4 indicate the success of Germany and Japan in keeping youth unemployment low, both in absolute terms and relative to adult unemployment. The one available data point for Switzerland, in 1993, also shows a low absolute and relative rate of youth unemployment. In these countries, employer involvement in setting standards and maintaining incentives in the education and training system ensures a flow of new employees who can achieve high levels of quality and efficiency at work. This helps firms expand their market share and create more jobs, as long as workers' compensation does not rise so fast that it precludes profits for investors.

Implications of Emerging Trends

Nevertheless, the conditions on which these systems are based appear to be changing. In the past, the transition from school to work has meant finding stable employment in an occupation, industry, or company. Now employment is becoming increasingly fluid, occupational boundaries are changing or dissolving, and more jobs are temporary (Cappelli, 1995; Carnoy, 1995). Because employers themselves are being forced to become more flexible in response to more rapid mobility of information and capital, work is increasingly "learning-intensive." This is true in large firms that are involving employees in continual problem solving. Continuous learning is also necessary for the growing number of workers who move from one temporary job to another (Seavey & Kazis, 1994). As described in the next section, employers are being pushed to explore new methods to engineer learning into the work itself. The boundary between learning and production is becoming increasingly difficult to define in many work situations. Under these new conditions, employer involvement in school-to-work systems no longer means helping schools train students for predictable jobs. Instead, employers and schools together are caught up in an evolution toward some new institutional arrangement where flexible production and continuous learning must happen at the same time.

This trend poses a challenge for school-to-work systems that have functioned well in the past in Japan and in the German speaking countries, as well as for countries where the school-to-work transition has already been relatively difficult. One challenge is to overcome the rigidity and fragmentation that sometimes afflict vocational training. Rapidly shifting markets and technology leave narrowly trained workers vulnerable. Preparing young people for hundreds of specific occupational categories may not be appropriate for the fluid world of learning-intensive work. Therefore, Germany and other countries where training systems are organized around strictly defined occupations have taken steps to reduce the number of vocational lines and broaden the skills that vocational students are taught.[5]

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[5] Jeff King suggests that the real issue here is not the number of vocational specialties, but "the question of how specific is 'specific' for an occupational training category. And if this is the real issue, as I think it is, then we need to find ways of talking about [it] which do not overlook the considerable synergies of higher order knowledge and cognitive skills, not to mention basic knowledge in math, science, and literacies (including foreign languages) built into well constructed technical training categories in lead country apprenticeship programs, where six years of a foreign language and several years of comparative religion and

A second major challenge to traditional systems is that many students are turning away from vocational tracks and seeking to enroll in academic streams leading to university. Increasingly, higher academic education is seen as the road to higher income and status. Even in Germany, there is some evidence that employers are recruiting higher education graduates for positions that had previously been filled by internal promotions of apprenticeship graduates. "The traditional careers of skilled workers are in certain sectors threatened by the competition of graduates from *Fachhochschulen* [polytechnics] and universities," according to Durand-Drouhin and Romani (OECD, 1994, p. 11).

In some German industries, a traditional career path has begun with apprenticeship leading to employment as a skilled worker (*Facharbeiter*), then followed by additional training at *Fachhochschule* and subsequent promotion. For example, Mickler (1996) has observed this career pattern in the machine tool design industry, where traditionally a large proportion of design engineers began as apprentices and skilled workers. Such engineers have had the advantage of being able to communicate easily with skilled workers responsible for actually producing the new tools or prototypes. However, the advent of computer-assisted design and simulation has led companies increasingly to recruit new engineers from among recent university graduates who are theoretically trained in experimental procedures, informatics, and electronics, but who have not served apprenticeships or gained experience as skilled workers. Mickler reports that the proportion of university-trained engineers in this industry grew from 17% in 1961 to 28% in 1987 and 33% in 1992. In those same years, the fraction from *Fachhochschulen* was 66%, 67%, and 63%, respectively, while the proportion of engineers who had not completed university or *Fachhochschule* fell from 17% to 5% to 4%. Consequently, "the number of good [secondary school] graduates who go through a vocational training in the enterprises to become a *Facharbeiter* and then stay there for long years as skilled workers has dramatically decreased" (pp. 15-16).

Policymakers in Germany and most other industrialized countries have therefore been questioning whether the traditional separation between vocational and academic pathways will remain useful in the emerging economy. Most countries have maintained separate vocational and academic education systems for students after their mid-teens. These systems are often housed in separate buildings, follow different curricula, target

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political science and economics at the U.S. community college level at least are the property of virtually all apprentices, even in hairdressing or auto repair."

different students, employ different kinds of teachers, and relate differently to other institutions and actors in society. In Germany, where most teenagers complete apprenticeships, the dual system has been able to maintain high academic standards, and the system is being constantly upgraded, in part to keep more young people from bypassing apprenticeship for higher education. In countries where only a minority of young people participate in vocational training, however, achieving high academic standards on the vocational side is more difficult.

One of the great pedagogical advantages of vocational education is that it often includes learning by doing that enables students to apply the concepts they are studying. But as the rate of technological change has continued to increase and the organization of work has become more unstable, the specific procedural skills imparted by vocational training risk becoming irrelevant. At the same time, academic education emphasizes more abstract theory and general analytic skills which should have more enduring value. Traditional methods of teaching, however, often leave graduates unable to apply their knowledge in a practical context (Resnick, 1987). Both vocational and academic education in their traditional forms therefore have certain strengths, but they are insufficient by themselves to prepare students for careers that will require continual learning in the context of work. In Germany, the dual system—linking schools with employers—provides a framework in which it is possible to combine the advantages of vocational and academic education. In countries that rely mainly on schools to provide vocational education, new initiatives have been designed in response to this challenge.

To inform the development of policy and practice in the United States, this report describes the apparent convergence of policies in industrialized countries toward four principles:

1. New curricula should be created that integrate vocational and academic studies.

2. Occupational and educational performance standards should be explicitly related to each other.

3. To prepare for learning-intensive work, initial education and training should include a certain amount of work-based learning for all students.

4. Employers and educators, including both vocational and academic educators, must share both responsibility and power in new school-to-work systems.

From the perspective of U.S. policy, the first principle is the most fundamental because it affects how the other three are implemented. Work-based education, skill standards, and employer involvement in education and training can all be achieved in a system that still preserves a sharp distinction between vocational and academic pathways. Therefore, in considering new policies to promote skill standards and work-based learning, it is crucial to ask whether they are being developed in a way that promotes continued divisions between vocational and academic education or, in contrast, promotes education more appropriate for learning-intensive work.

The next section of this report, "Learning-Intensive Production," describes in more detail how work is becoming more learning-intensive. Some of the measures taken in several countries to integrate vocational and academic education are then summarized in the section entitled, "Integrating Vocational and Academic Education." Three components that are considered important in successful school-to-work systems are elaborated in the sections entitled, "Skill Standards," "Work-Based Learning for Students," and "Governance": skill standards that reinforce rather than conflict with the integration of vocational and academic education; work-based learning that is well-coordinated with vocational and academic instruction in school; and emerging educational governance strategies that share power between employers and educators. Special attention is given to whether these components have been used in conjunction with efforts to bring vocational and academic education closer together. The final section adds a concluding note.

LEARNING-INTENSIVE PRODUCTION

Increasingly rapid mobility of information and capital is forcing firms to become ever more nimble. Constant change within organizations and mobility of workers among firms require everyone to keep learning all the time. Learning includes the transfer of existing information, knowledge, and skill from those who have them to those who need them. It also includes the discovery of previously unknown facts and principles, both to improve current routines and to handle new problems. Within firms, the accumulation of many small new discoveries is vital to the continuous improvement of products, services, and methods of production. This is a knowledge-based economy. More importantly, it is learning-based because the success of companies and individuals depends especially on how fast new information can be acquired and assimilated.

More rapid change in markets and technologies makes it relatively more efficient to locate the creation and acquisition of productive knowledge close to the actual productive process. When knowledge and skill related to equipment, software, and operating procedures are developed outside the work situation, they are increasingly likely to be obsolete before they can be put to use. Growing evidence points to the cost-effectiveness of work-based compared to school-based training (Elias, Hernaes, & Baker, 1994; Middleton, Ziderman, & Van Adams, 1993). In particular, the worksite is the best place to generate ideas about continuous, incremental improvement in working methods. For these reasons, firms and schools alike are displaying greater interest in how work itself generates productive competence (Berryman & Bailey, 1992; Lave & Wenger, 1991).

When business firms operate in competitive markets without institutional supports for training, they tend to view training as an expense to be minimized. Employers would generally prefer to hire ready-trained workers—or buy or affiliate with another company that possesses the desired expertise—than provide the training themselves. Institutional structures that overcome these tendencies are the dual system for initial vocational training in German-speaking countries, the French system for continuing staff development, and the Japanese system of long-term employment contracts for core employees. In each of these cases, special economic incentives have been created to override individual firms' reluctance to provide training (Berton, Podevin, & Verdier, 1991; Koike, 1988; Soskice, 1994).

A basic reason why firms generally prefer to minimize their outlay for training is that they lose their investment when employees leave (Becker, 1964; Lynch, 1994; Stern & Ritzen, 1991). Increasing mobility of employees among firms should therefore tend to strengthen employers' reluctance to offer training.

On the other hand, the more rapid obsolescence of work-related knowledge and skill makes it more difficult for employers to find exactly what they need on the open market. They must somehow develop it themselves. Furthermore, as firms offer less employment security, they may try to compete for the most qualified people by offering instead greater opportunity for self-improvement on the job. The opportunity to acquire skill and knowledge that may be useful in a future job becomes more valuable for employees as there is less assurance of remaining with the current employer for a long time. A good case in point is the temporary staffing business itself. One firm that has

grown as a direct result of the trend toward more short-term employment is Manpower, Inc., which in 1992 employed a larger number of people than any other U.S. company. Manpower, Inc. provides temporary staffing to other companies and has created a highly structured method for enabling its employees to consolidate and develop their skills and knowledge as they move from one assignment to another (Seavey & Kazis, 1994).

In the absence of institutional structures or incentives that support training, the main strategy enterprises can use to minimize their training costs and at the same time promote employee development is *on-line learning*. This means acquiring skill or knowledge at one's regular work station and in conjunction with the regular work process, instead of through classes or instructional activities at a different location. Learning that is embedded in the work process inherently entails less opportunity cost than learning off-line. Like just-in-time inventory control, on-line learning avoids unnecessary investment and minimizes deterioration of knowledge and skill from non-use. The need to solve an immediate problem also provides both a motivation to learn and a context that makes new information meaningful.

Firms are developing new practices to promote on-line learning. There is no systematic evidence about which arrangements are most effective, but some of the emerging practices can be described as follows:

Cross training by coworkers involves creating teams of workers with complementary skills and knowledge, who teach one another. Such arrangements have become commonplace in manufacturing, spurred by the diffusion of the Japanese model of "lean production" (Womack, Jones, & Roos, 1990). Firms in service industries are also increasingly organizing employees into teams and encouraging members to share knowledge and information. For example, customer service representatives who formerly carried out highly fragmented tasks are now more often grouped into teams with responsibility for a broader range of functions. The reorganization requires team members to train one another in their respective specialties. One insurance company has created a written list of all the separate tasks a team should perform and pays individual team members additional salary if they master more of these tasks; managers have observed that employees now use idle moments to exchange work-related information instead of talking about other things (Brown, Reich, & Stern, 1993).

Job rotation gives individuals an opportunity to broaden or deepen their skills through exposure to a planned sequence of tasks. This is a hallmark of human resource development in Japanese firms where employees normally remain with the same employer for a long time (Koike & Inoki, 1990). The long career in one firm makes it possible to broaden knowledge and deepen skills by moving workers through a sequence of related jobs over the course of many years. It is not unusual to find, among the information posted in a work area, a chart displaying the level of competence of each worker in performing the jobs done there and a plan for the next set of assignments designed to increase everyone's competence.

Skill-based pay or pay for knowledge is a major departure from traditional practice in Europe or North America. Standard compensation practice makes an individual's pay for a given period depend on the job classification to which the person was assigned. Skill-based pay adds a salary increment that depends on the individual's demonstrated mastery of certain knowledge or skills, independent of the job actually performed during the pay period. To the extent that salary depends on competence rather than position, employees become more willing, even eager, to accept reassignment to different jobs. A survey in the U.S. by Osterman (1994) found that 30% of establishments awarded skill-based pay to at least some of their employees. This is remarkable given that the idea was unknown in the U.S. until the early 1970s. The principle that pay follows the person, not the job, is also a feature of the compensation system in large Japanese companies.

Formal or informal groups (e.g., quality circles) may be created to discuss problems, develop new procedures, or codify current knowledge or skill. These are well-known as a method for involving employees in solving problems related to quality and efficiency (Applebaum & Batt, 1994; Cole, 1989). In France, small groups of workers in newly emerging jobs have been formed for the purpose of writing down the knowledge and skill required (Barbier et al., 1992). An additional effect of these group activities is to keep employees' minds engaged in thinking about what they are doing, a basic prerequisite for learning.

Suggestion systems reward the contribution of ideas by groups or individuals to improve products or work processes. Incentives may be provided for continual discovery of problems and solutions. Like quality circles, suggestion systems help to engage workers' minds even if the work itself is largely repetitive. Along with quality circles,

suggestion systems are used extensively in Japanese firms, some of which elicit an average of one or two suggestions per employee per week; workers are paid a small amount of money for each suggestion, and a larger amount if the suggestion has substantial value to the company.

Off-line training may incorporate "doing by learning" (Stern, 1992a). That is, problems originating in the work itself are analyzed in the course of classroom instruction, resulting in ideas for solutions that can be implemented in the work setting. For example, a class may introduce the concept of cycle time or five-step problem-solving, then ask participants to apply the concept to real problems in their own work. The benefit of on-line learning is achieved by bringing the work process into the classroom.

Certain employees may be designated as mentors or tutors for coworkers. This role has been formally developed to the greatest extent in German initial vocational education where an apprentice must be supervised by a qualified *meister*. The French have also created the role of *tuteur*, who supervises young trainees in the workplace (Brochier, Froment, & d'Iribarne, 1990) or who guides regular employees through the requirements to obtain a vocational qualification (Kirsch, 1990).

Written analysis of work problems may be assigned as a condition for promotion or advancement. This is another common practice in Japan where candidates for promotion may be asked to write a 20- to 50-page paper proposing a solution to a particular problem or a set of improvements to current methods. The higher the position, the more substantial the essay.

Job aids may be provided in such forms as computerized "help" menus, databases, and expert systems. The spread of computers in workplaces has made it possible to replace printed manuals, which are clumsy to update, with on-line help functions that can be updated continuously (U.S. Congress, Office of Technology Assessment, 1990). From computer-controlled machining to health care to banking, computer application software, databases, and expert systems increasingly offer on-the-spot guidance and information for workers.

Groups or networks may link different workplaces with similar problems. Billboards and list servers on computer networks provide the means for fast exchange of

information. Potentially, this could be an important tool for communicating solutions to problems in different workplaces. However, such communication may be blocked by companies' proprietary interests.

To the extent that on-line learning results in workers becoming more interchangeable and easier to replace, it would increase the bargaining power of employers relative to employees. On the other hand, to the extent that opportunities for additional learning at work are associated with increased reliance on staff members' intellectual contributions, the balance of power shifts in favor of employees. This is reflected in several of the practices described above, including problem-solving groups and systems that reward workers who propose significant new ideas.

Because firms must continually seek improvements in their products, services, and methods of operation, staff are increasingly expected not only to adapt to change but also to initiate it by proposing their own ideas. Increasingly, employers must rely on ideas offered by employees. But what kind of incentive can elicit significant new ideas? Coercion is out of the question. Monetary rewards can induce people to submit large numbers of written suggestions, but the Japanese experience indicates that the changes proposed tend to be tiny. Bigger ideas arise only out of genuine interest. The parent of creativity is curiosity.

INTEGRATING VOCATIONAL AND ACADEMIC EDUCATION

To prepare individuals for work that demands autonomy and continual learning, many employers now call for education that promotes high-level thinking skills for all students, not just for the elite as in the past. Vocational education, which traditionally has offered practical training for students who were considered to possess relatively low academic ability, is now being reformed and in some places radically reconstituted. Reforms include strengthening the academic content of vocational classes and making it easier for vocational graduates to pursue further studies at the university level. These changes are intended to attract more intellectually talented students into vocational programs, to give them sufficient theoretical grounding to deal with changing technology, and to prepare them for continual problem solving. As change proceeds in this direction, the line between vocational and academic education becomes indistinct. Instead of serving

as an alternative to general education, vocational education becomes a method for promoting it. At the same time, the teaching of academic subjects in many countries is moving toward more active pedagogy that often features production of student projects, though these are not necessarily related to present or future employment. The trend toward convergence of vocational and academic education mirrors the growing interconnection between production and learning in the workplace.

Developments along these lines are occurring in all major industrialized countries. For a basic description of the vocational and general educational systems in the G 7 countries, see Medrich, Kagehiro, and Houser (1994). Here the focus is on recent changes to the existing structure.

Japan unveiled a new "integrated" vocational academic high school course in 1994 (Japanese Ministry of Education, Science, and Culture, 1995, pp. 47-52). Until then, Japanese high schools offered either a prescribed general curriculum as preparation for university or a specialized vocational curriculum. The proportion of students attending vocational high schools fell from 40% in 1955 and 1965 to 26% in 1992. Therefore, beginning in 1994, high schools were permitted to offer an integrated curriculum focusing on career development. Students in the integrated program have fewer required subjects and are given career guidance to help them design their own course sequence. As of 1994, only seven schools had introduced the integrated curriculum but it was expected that the idea would catch on and promote "convergence of vocational and general education" (Yoshimoto, 1994, p. 5). This convergence already has occurred to some extent at the postsecondary level through the growth of special training colleges offering higher diplomas in industrial, commercial, and other vocational fields. Enrollment in these institutions stood at 862,000 in 1992, double the number in 1978, and more than one-third the 1992 enrollment level in universities.

France has created an array of upper secondary diplomas: general, technical, and vocational. Around age 15, after four years of lower secondary school, most students either continue in a three-year upper secondary program toward a general or technical diploma or enter a two-year vocational program. The vocational diploma was first introduced in 1985 to give graduates of two-year vocational programs an option to receive an upper secondary diploma after an additional two years. As of 1991-1992, the number of

students enrolled for the vocational diploma had grown to 114,000 compared to 707,000 preparing for general and 290,000 for technical diplomas (Kirsch, 1994).

French students holding a secondary diploma can pursue further vocational education in several ways. Secondary schools themselves offer programs leading to higher technician diplomas. Two-year technical institutes within the universities also offer technical diplomas. The university technical institutes were created after uprisings in 1968 to give working-class students access to the university. Until the late 1980s, most graduates entered the workforce. However, the recession of the early 1990s has made it more difficult to find good jobs and larger numbers of university technical graduates have been continuing their studies at the university. This has caused some problems with university professors protesting that the application-oriented curriculum of the technical institutes does not provide sufficient theoretical preparation. At the same time, the two-year technical institutes are trying to add a third year which would purportedly be spent mainly in workplaces, thus encouraging graduates to enter employment. The controversy over the French university technical institutes reflects one of the dilemmas in combining vocational and academic education: if the academic content is rigorous enough to attract academically talented students, the vocational mission of the program may be forgotten. This dilemma may arise again in connection with new four-year university professional institutes that have been created to give another point of entry to the labor market at a still higher level of the educational system.

Norway introduced a comprehensive reform of its upper secondary education in 1994. The three-year sequence starts with a common core curriculum in the first year, then offers choices for increasing specialization in the next two years, with considerable work-based learning in the third year. Students who complete a vocational sequence but then decide to go on to university may do so after completing one additional year of study.

In ***Germany***, as discussed in the first section, the dual system of apprenticeship is widely regarded as a successful model for initial vocational education (see Hamilton, 1990). A series of studies in the 1980s pointed to the effectiveness of German training, in particular, as compared to training in Britain (Daly, Hitchens, & Wagner, 1985; Prais, Jarvis, & Wagner, 1989; Steedman & Wagner, 1987, 1989). These studies found that German firms in certain manufacturing and service industries were more productive than similar firms in Britain. After carefully observing the production process, and taking into

account any differences in the quality of equipment, the researchers concluded that the level of skill acquired by German workers in their initial training seemed to explain much of the difference in workplace productivity. For example, German mechanics were better able to keep equipment operating because they knew more engineering than their British counterparts.

Imparting a high level of theoretical and academic knowledge is an important goal of the German dual system. Soskice (1994) points out that employers encourage academic achievement by awarding the more sought-after apprenticeship positions to students who have performed better in school. In recent years, the school-based portion of apprenticeship training in most of the German states has begun to include a critical analysis of technology, so that students are better prepared to participate in the "active shaping" of technology and work. A greater amount of time has also been set aside for teaching general academic subjects. Hermann Schmidt (1994), President of the Bundesinstitut fur Berufsbildung (BiBB), which oversees the apprenticeship system, has declared that "the separation between general and vocational education is becoming obsolete" (p. 9).

Traditionally, the separation between the pathways of apprenticeship and university has been clear: Students who attended a gymnasium and received the Abitur diploma went to university, while the others entered apprenticeship. However, in recent years, a growing number of Abitur holders are completing apprenticeships prior to entering university. Rauner (1995) reports that the proportion of university students who had completed apprenticeships grew from 21% in 1985 to 30% in 1994. Evidently these students have decided they want even more theoretical and academic preparation than the dual system provides. One reason, already noted in the first section, is that some employers are reportedly turning to universities and polytechnics (*Fachhochschulen*) to supply high-level employees. Steedman (1993) observes

> a relatively new phenomenon . . ., the difficulty being experienced even by the most prestigious engineering firms in recruiting trainees of the necessary high ability and aptitude. Respected commentators . . . have, as a result, diagnosed a crisis of the whole [apprenticeship] system arguing that if the high-cost high-quality training provision of the prestigious industrial companies is discontinued in favor of recruitment from higher education, then the credibility of the system as a whole will be undermined. (p. 1288)

Although Steedman herself concludes that the dual system is still strongly supported in Germany, policymakers are concerned that if large numbers of high-achieving students begin to view higher education as a better path to work than apprenticeship, the dual system might deteriorate. To prevent students' demands for university education from undermining the dual system, "The social partners share the view that the transition to higher education institutions and universities should also be ensured or at least made easier for graduates of the dual system," according to a senior official in the BiBB (Laur-Ernst, 1992, p. 40).[6]

The ***United Kingdom*** is in the process of introducing a new set of vocational qualifications called General National Vocational Qualifications (GNVQs). At the advanced level, these are intended to be the vocational equivalent of academic "A level" examinations, which are required for entrance to university. GNVQ courses are currently offered or planned in 14 fields, including art and design, business, construction and the built environment, engineering, health and social care, leisure and tourism, manufacturing, hospitality and catering, information technology, and science. The government is encouraging all institutions of higher education to accept GNVQs in combination with or instead of A levels. The 1991 White Paper on "Education and Training for the 21st Century," which inaugurated the new program, declared, "The government wants to remove the remaining barriers to equal status between the so called academic and vocational routes" (paragraph 4.2).

The first year in which students completed advanced GNVQs was 1994. In that year, 772 applied for admission to higher education, and 85.3% received at least one offer (UCAS, 1996). In 1995, the number grew to 8,525, and 89.1% received offers. UCAS, the clearinghouse for applications to institutions of higher education in Britain, reported that 91.6% of the 19,353 GNVQ holders who applied in 1996 received at least one offer of admission, compared to 88.4% of the total 379,582 applying for admission to higher education. The GNVQ field accounting for the largest number of applicants in 1996 was business, with 10,223 applicants, of whom 96% received at least one offer. Another 3,010 applicants held advanced GNVQs in leisure and tourism; 93% of these received offers. Of

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[6] Jeff King notes that "the increased access to and use of the polytechnics and *Fachhochschulen* by skilled workers up-grading skills and qualifications beyond Technician or *Facharbeiter* levels means that firms and workers can either alternate work and higher education or pursue both simultaneously through evening and weekend degree programs . . ., thus reducing the appeal of pure recruitment from higher education alone."

the 2,674 applicants who held advanced GNVQs in health and social care, 77% won offers. No other field accounted for more than 1,000 applicants in 1996. These figures indicate that the GNVQ has become an accepted route to higher education.

While the social demand for higher education in other industrialized countries is giving rise to policies that attempt to preserve vocational education by linking it to the university, the pressure for universal access to higher education is even greater in the ***United States***. Conceived in revolt against monarchy and the feudal aristocracy that went with it, this country has traditionally placed great value on equality of educational opportunity. In fact, the proportion of young adults who complete a bachelor's degree or more (including a master's, which is the first higher education degree in several countries) is higher in the United States than in any other OECD country except Canada (OECD 1995a, p. 219). A high school graduate may decide not to go to a four-year college or university right away, but keeping the option open for the future is considered important in case a person wants to change careers or is forced to do so. Including college-bound students in career preparation programs also prevents the programs from being stigmatized as second-best.

The clarification of this commitment in U.S. policy can be seen in the evolution from the 1990 Carl D. Perkins Vocational and Applied Technology Education Act to the 1994 School-to-Work Opportunities Act. The 1990 Perkins Act mandated vocational and academic curricular integration and also provided support for Tech Prep programs, which link the last two years of secondary school with the first two years of postsecondary education (Hull & Parnell, 1991). The School-to-Work Opportunities Act repeated the appeal for curricular integration; called for the addition of work-based learning; and also urged the linking of secondary to postsecondary education, including not only two-year colleges and technical institutes but four-year colleges and universities.

Grubb (1995) provides examples of various approaches to high school reform that combine vocational and academic curriculum and prepare students for both careers and college. Stern, Finkelstein, Stone, Latting, and Dornsife (1995) report evidence that such approaches have improved students' performance in school. Business Week magazine (1996) has published descriptions of ten "new American high schools" that use integrated vocational and academic curriculum as the basis for whole-school reform. The National Association of Secondary School Principals has endorsed this strategy in a statement

written with Jobs for the Future (1995). The National Council of Teachers of Mathematics and the National Science Teachers Association have both published curriculum standards that emphasize the value of understanding in a practical context. Many schools are using the study of technology to teach theoretical concepts in mathematics and science (Raizen, Sellwood, Todd, & Vickers, 1995). The National Center on Education and the Economy (1995) has published suggested standards for student performance that weave applied learning together with English, mathematics, and science; examples of actual students' work from various school districts are included. These and other initiatives indicate widespread interest in blending the vocational and academic curriculum so that students are prepared for both college and careers.

The dichotomy between vocational and academic will not disappear quickly or without struggle, since the old disciplines have long been entrenched and there is a strong tradition, especially in Europe but also in the United States, of using secondary education to sort students into various levels of the occupational hierarchy. But pressure is growing to create something new because work increasingly requires continual learning and it is becoming more difficult to attract talented or ambitious students to traditional vocational education. Fundamental change may take years or decades, but the pressure is being felt throughout the industrialized world, and educational authorities are responding.

SKILL STANDARDS

Industry-based skill standards play an important role in the school-to-work education system articulated in the School-to-Work Opportunities Act. Policymakers, education reformers, and analysts argue that a well-functioning system of standards will have many positive benefits. Standards tell students what they need to know to enter a particular occupation; indicate to employers the skills and abilities of applicants; facilitate the assessment of educational institutions; and, perhaps most important, provide a forum for employers and schools to work together.

There are two important points concerning the history and development of standards in the United States. First, skill standards in this country are not new. Over the last few decades, states and occupational groups have developed a plethora of systems for

setting standards and assessing skills. Nevertheless, contemporary standards advocates see the current reform movement, which will be coordinated by the National Skill Standards Board established by the Goals 2000: Educate America Act of 1994 as a significant break from these disparate and uncoordinated past systems because it is hoped that the new standards will be adopted nationwide and thus maximize portability within the United States. Second, the emerging interest in standards during the last few years is very much linked to perceptions about the changing workplace based on the increasing importance of learning-intensive work which focuses on the application of more general, traditionally academic skills to the workplace. Given the current emphasis on broad-based workplace skills, the adoption of skill standards should reinforce the integration of vocational and academic education.

To what extent have current skill standards efforts in the ***United States*** promoted greater integration of vocational, academic, and generic skills? On the one hand, at least through the middle of the 1990s, the movements to develop academic and industry-based skill standards have been developed independently with little interaction between individuals involved in the two movements. The National Skill Standards Board has a very strong industry focus, as it was designed to have, and, so far, educators have not been significantly involved with many of the skill standards pilot projects funded by the U.S. Departments of Labor and Education to develop models and practice. The majority of these skill standards models still conceptualize vocational and academic skills separately (Bailey & Merritt, 1995).

On the other hand, some of the skill standards pilot projects have attempted to integrate occupational and academic skills. The New Standards Project of the National Center on Education and the Economy in collaboration with the LRDC (Learning Research and Development Center) has contributed to the formulation of integrated standards. Two trends in the design of standards systems suggest progress, and both of these trends are strongly endorsed by the National Skill Standards Board. The first involves the attempts to incorporate generic workplace skills such as problem solving and teamwork (SCANS skills) into the systems of standards. While the use of SCANS skills is not the same as a comprehensive attempt to integrate vocational and academic education, it does move beyond a specific focus on narrowly defined vocational skills. Although most of the skill standards pilot projects are still trying to determine how to incorporate generic skills into their systems, there is little disagreement that it is necessary. The second trend that moves

education away from narrowly defined occupational skills is based on broadening the definition of the occupations. In some, although certainly not all of the pilot projects, designers have tried to set standards for broad occupational clusters instead of narrower occupations.[7]

The goal of a contemporary standards movement cannot be simply to set recognizable standards. After all, the United States already has extensive experience with occupational and professional standards, though these are often set by individual states and not recognized nationally. Rather, standards must be seen in the context of a broader education reform movement. Industry skill standards can easily solidify past practices. This can be true even if standards have many characteristics called for by reformers such as portability, national recognition, modularization, and development through intensive employer input. This section considers some of the experiences in other industrialized countries with using standards to promote the stronger integration of vocational and academic education.

The great strides that ***Australia*** has made in improving its vocational education and certification process have centered around broadening vocational credentials. Indeed, major elements of the country's training reform agenda involve improving the efficiency and output of vocational education, making it more acceptable and relevant to high-performance industry needs.

Competency-based training (CBT) is a quality assurance system concerned primarily with training, assessment, and credentialing to meet industry-specific standards. The Vocational Education, Employment and Training Committee has defined the key features of the Australian CBT system:

> Essential aspects of a CBT (competency-based training) system are that delivery, assessment, and certification of training should relate to the

[7] Jeff King notes that "the question of integration of academic and vocational skills seems to turn on related issues of connecting 'generic skills' to 'occupational skills.' And perhaps so. But what does not seem to be considered . . . is the *possibility that generic skills may themselves be a product of contextualized learning within occupational categories*, both those which are 'narrow'—if deep enough also—and those which represent 'broad occupational clusters.' (Cognitive returns to scale issues again [see note 5 above].) . . . Must it be the case that deep training in technical specialties necessarily forecloses 'generic' skills? What if the technical specialty is itself based on very broad and deep learning in basic arts and sciences disciplines—math, science, comprehensive literacies, etc.—as well as technical specialties both using and advancing the subtlety of this basic knowledge? It seems to be an underlying assumption here that technical training in occupations cannot do this. But it can . . . ."

> identification of, instruction in, and demonstrated attainment of the knowledge, skills, and applications required for effective performance at the required level, as defined in competency standards. (OECD: Australia, 1992, p. 10)

Competency-based training and assessment are essential features of the Australian Vocational Certificate Training System. The new national framework for defining occupational standards includes the Australian Standards Framework, which defines eight competency levels hat apply to all industries (from entry-level to bachelor's degree level) and the National Training Board, which works in consultation with industry to endorse national competency standards. For more than 20 broadly defined industries, such as metals and engineering, building and construction, and so on, Industry Training Boards or Industry Training Councils have been created. These bodies have been asked to define standards to "ensure that workforce entrants are equipped with both the key competencies and specific industry and occupational competencies" (OECD: Australia, 1994, p. 2).

The competencies defined are of two kinds: (1) "key competencies," which show a striking resemblance to SCANS skills in the United States; and (2) "functional competencies," which deal with employment-related skills in workforce preparation programs. Functional competencies include aspects of the key competencies, but they also include industry-specific skills, and they are written in industry-specific terms (Bishop, McDonald, & Manidis, 1994). Australia's reforms seek to incorporate key competencies into entry-level training courses for all young people regardless of their chosen career path (OECD: Australia, 1994).

Education and training portfolios have been integrated by the Ministers for Vocational Education, Employment, and Training (MOVEET) so that vocational competency standards will be formally linked to vocational curriculum and its accreditation to form more solid pathways for students. It is now broadly accepted that traineeship and apprenticeship systems should be brought together under a common framework that integrates the Vocational Education and Training (VET) curriculum taught in secondary schools with the postsecondary Technical and Further Education (TAFE) institutions. MOVEET agreed to move toward a new, unified, entry-level system incorporating and expanding upon the apprenticeship and traineeship systems and their qualifications (Noonan, 1994).

Efforts to integrate, both conceptually and structurally, employer-based training with training located in schools and colleges have led to an easier articulation and transfer of credits across vocational institutions. By agreeing to a series of assessment principles and processes that minimize the importance of where and when training takes place, training undertaken at work and previous knowledge and skills are now recognized and allowed to serve as the basis for the achievement of publicly accredited qualifications and competency standards. Not only does this affect worker credentialing, but the designers of curriculum now have greater latitude to modularize training in various ways leading to formal qualifications (Noonan, 1994).

Australia has made important progress toward reforming its system of vocational standards. This has promoted integration among vocational, academic, and generic skills in various vocational institutions and between secondary vocational education and postsecondary technical education. At the same time, this new system has influenced the academic high school curriculum in every state (Keating, 1995). Fifteen years ago, Australia's high schools were largely academic institutions, focusing primarily on preparing students for university entrance examinations (Vickers, 1991). Only one-third of each youth cohort graduated from high school, while the remainder left school at the end of 11th or 12th grade to enter vocational training programs in TAFE colleges or to enter the workforce. The only students who graduated from high school were those who completed a full program of academic subjects and passed the matriculating examinations (Vickers 1991, 1995a). Today, Australia's high school graduation rates are equivalent to those in the U.S., and there has been a revolution in the content of high school curriculum. Key competencies (equivalent to SCANS skills in the U.S.) are being incorporated into upper secondary school courses in every state (Keating, 1995). A wide range of new, occupationally oriented courses have been developed and introduced into the high schools, and in some cases, students are studying TAFE college courses while still in secondary school. Because Australia's national system of vocational standards is now in place, many of the new curricula being developed by the states conform to those standards. Many high school students now gain a nationally recognized occupational credential when they graduate from high school, and these credentials are recognized by the TAFE colleges (Australia: NBEET, 1994).

However, there are inevitable tensions between the norms and values of the vocational and academic education systems, and a recognition that it would be difficult to

achieve a complete integration of the two. For example, while occupational credentials gained at high school are recognized by TAFE colleges, university admissions authorities tend to place more emphasis on success in academic subjects. Recognizing the inherent difficulties in unifying the two systems, Australia's planners have stated that it is their intention to integrate vocational and academic education "to the extent this is feasible" (OECD: Australia, 1992, p. 19).

Policymakers in ***England*** and ***Scotland*** have explicitly tried to develop two parallel but equal educational streams, one vocational and one academic. The development of the vocational stream has been keyed on assessments designed to promote the integration of vocational and academic education through General National Vocational Qualifications (GNVQs) in England and Wales, and Scottish National Vocational Qualifications (SNVQs) in Scotland. These reforms have many positive elements, although there are some limitations. The role of the GNVQs can best be understood in contrast to the National Vocational Qualifications (NVQs) which were established in 1986. The NVQs are comprised of specific work-related competencies established by industry groups (lead bodies) and assessed in the workplace. They are designed to measure and certify the ability to carry out specific workplace functions (although these could be highly complex) and to be independent from educational institutions, thus allowing for the certification of skills that are acquired purely on the job or in other nonschool settings (OECD: United Kingdom, 1994).

The NVQ system has many critics. While NVQs prepare students for particular jobs and occupations, critics argue that they are too specifically task-based. Since the skills involved are specific to industries and not transferable across industries, any general academic skills or knowledge embedded in them is in effect not certified or capable of being formally recognized by other industries. The assessment system is also criticized for not being sufficiently independent, since the employers often both do the training and assess that training (Payne, 1994). It is also not clear whether employers have the capacity to train for many of the NVQs (Vickers, 1994). Overall, the NVQ route contrasts sharply with the course of study taken by university-bound students.

At the advanced level, the GNVQs are intended to be equivalent, but still separate, from the academic A level examinations required for students seeking admission to university. Thus, the GNVQs cover general knowledge areas for young people in full-time

education. As noted in the previous section, the number of advanced GNVQ holders applying to institutions of higher education has grown rapidly to nearly 20,000 in 1996, and more than 90% of these succeeded in winning at least one offer of admission (UCAS, 1996). Thus, in contrast to the NVQs, GNVQs are explicitly aimed at encouraging the integration of vocational and academic education and appear to have accomplished their explicit purpose of bridging the separation between vocational and academic streams. While the GNVQs are a bold reform, critics have argued that the GNVQs tend to neglect some of the conceptual and theoretical knowledge that underlies relevant practice. Moreover, there is still a long way to go before the GNVQ system can achieve full parity with the traditional academic route (Payne, 1994).

Similar to the English system, the Scottish system has attempted to integrate vocational and academic credentials at the postsecondary level through the General Scottish Vocational Qualifications (GSVQs):

> Unlike occupational SVQs, GSVQs will not be designed as statements of competence as defined by lead bodies [industry organizations], but will focus on the skills, knowledge, and understanding that underpin a range of SVQs, within a broad occupational area. They will therefore be designed so that the outcomes to be achieved can be developed and assessed in colleges and schools, whilst maintaining an emphasis on application. (OECD: Scotland, 1994, p. 5)

GSVQs expose students to a number of related occupational, work-readiness, and general education skills and are developed for young people who either wish to progress into higher education or to go immediately into employment, as well as for adult returners. Thus, like the GNVQs in England, the GSVQs represent an attempt to define much broader occupational areas and to introduce some integration of vocational and academic education.

Scotland has a longer history than England of attempts to integrate vocational and academic education and to increase the status of vocational studies. The GSVQs have been built on a broad reform agenda introduced by the 1983 Scottish Action Plan, which also tried to bring vocational and academic education closer together. The Scottish Action Plan developed a modular system of vocational qualifications awards with input from both employers and Further Education Colleges (similar to community colleges in the United States). The flexible certificate system which leads to a National Certificate (NC) is available in over 3,000 modules (each representing 40 hours of study) and was designed to serve the diverse needs and interests of students and employers. NC modules can be used

to meet parts of the high school graduation requirements and can act as stepping stones to advanced-level vocational qualifications. This system was aimed, among other objectives, at allowing individuals to mix vocational and academic education; encouraging greater participation in further and higher education (by facilitating credit transfer, progression, and choice); and encouraging active, practical, and student-centered approaches to learning and teaching (OECD: Scotland, 1994, p. 9).

An interesting feature of the Scottish Vocational Qualification framework is the use of modules or units of learning in the NC. Individual modules can be built into group awards similar to occupational or educational clusters, and tailored to meet established national criteria as well as specific employer and student needs. They cover a wide range of subjects, including engineering, finance, agriculture, tourism, science, languages, arts, building, and health. The modular or cluster format was also being used in Further Education Colleges leading to Higher Certificates (higher-level academic degrees) and Higher National Diplomas (higher-level vocational degrees). These group awards are now forming the basis of the GSVQs.

Although the NC system allows students to combine vocational and academic courses in broad occupational clusters while leaving open the option of higher education, the vocational and academic paths are still divided. Some NC modules had formal equivalence to the academic Highers and were recognized for entrance into university, but there remain two distinct routes to higher education and a persistent disparity in esteem between the vocational and academic credentials (OECD: Scotland, 1992, pp. 13-14; OECD: Scotland, 1994, p. 12).

As a result of these perceived deficiencies, Scotland is introducing another series of reforms for higher-level secondary education. These reforms are designed to strengthen the links between vocational and academic education, increase the vocational content of academic studies and the academic content of vocational studies, and reduce further the contrast in status. In the last years of secondary school courses, students following the traditional academic route (overseen by the Scottish Examination Board) and those following the vocational route (overseen by the Scottish Vocational Education Council)—including those leading to the General Scottish Vocational Qualification (GSVQ)—will be brought into a unified curriculum and assessment system leading to a restructured secondary school diploma. This will incorporate academic and advanced occupationally

related subject matter into a reformed and unified stream. The SVQ system will remain as a separate system for "those [students] for whom Highers are inappropriate" (OECD: Scotland, 1994, p. 13). Thus, despite widespread attempts to unify the two streams, a credential-based lower stream will remain, at least for some students.

In ***Denmark***, a growing emphasis on academic rigor in the first year of vocational training, combined with more valid assessments involving employers and educators throughout the learning process, "contribute to placing vocational education on an equal footing with other educational disciplines" (Danish Ministry of Education and Research, 1992, p. 4). The coordination required to maintain continuous dialogue between industry mentors and school-based instructors on pedagogic and assessment issues leads to a greater understanding of vocational credentials among all constituencies, especially employers, and aids in increasing the quality and reputation of vocational education programs.

All vocational education and training courses in Denmark culminate in a "skilled worker certificate" issued by Trade Committees (OECD: Denmark, 1994). As in Germany, the overall educational experience leading up to it represents a solid combination of general, academic, and vocational courses:

> A supreme objective of vocational education and training policy in Denmark is to preserve the versatile character of vocational training and to provide genuine opportunities for continued training. The courses must also contribute towards the aim that not only young persons who choose a general upper-secondary education, but also those who choose vocational training in a specific trade should have general education. (OECD: Denmark, 1994, p. 8)

Upper secondary vocational students now take basic, area, special, and optional subjects in the school portion of their vocational training which are "not solely aimed at acquiring technical and professional competence within a narrow professional framework" (OECD: Denmark, 1994, p. 8). Basic subjects encompassing one-third of the school curriculum include practical and theoretical training in traditional academic areas such as language, math, and social studies. These subjects must "provide both technical breadth and enhance personal development; qualify students for further studies; and convey an understanding of society and its development" (Danish Ministry of Education and Research, 1992, p. 3). Area subjects, also one-third of the school curriculum, focus on practical and theoretical training for broad occupational fields and provide general as well as specific vocational qualifications. The remaining one-third of school-based vocational training is divided

between special and optional subjects that offer students more specialized and professional training often geared toward particular company needs.

Denmark has established a series of upper secondary vocational training courses leading to graduation through either a higher technical exam (HTX) or a higher commercial exam (HHX), both of which have become valid alternatives to general upper secondary education and contribute to the increasing reputation of vocational education relative to general education. These vocational routes, established by law in 1990, share many structural and content features with general upper secondary schools such as theoretical courses in the second and third years (OECD: Denmark, 1994). Maintaining the Danish goal of educational mobility, they have become an equally valued alternative to general education because they qualify students for admission to higher education as well as employment. Passing these courses allows for admission to university higher education courses, advanced commercial courses, and engineering diploma courses. Østerlund (1994) reports that substantial percentages of students in these vocational programs do transfer back to the university track. While maintaining distinct vocational and academic secondary level credentials, the Danish system increasingly permits students to cross back and forth between the two pathways.

The many strengths of the ***German*** system have received widespread attention in the U.S. (Commission on Skills of the American Workforce, 1990; Hamilton, 1990). At the same time, the German system itself is continuing to evolve as educators and employers in that country try to adapt to changing economic conditions and skill requirements. For example, Rauner (1995) argues that the "traditional pragmatism and history of the German occupational structure is certainly not a sufficient basis for a forward-looking professionalisation of occupations" (p. 12). He points out that traditional German occupations and their associated certification tend to be defined by specific technologies, but increasingly rapid changes in technology destabilize the labor market and tend to undermine the associated occupational structures. In contrast, professional occupations such as doctors and engineers, traditionally trained in universities, have maintained a stable culture and identity despite changes in technology. Thus, analysts within the German apprenticeship institutions are working toward strengthening the teaching of interdisciplinary and social skills required for self-reliant occupational competence (Federal Institute for Vocational Training, 1994, p. 13). These reforms are given impetus by reports, noted in the first section, that employers in some industries who used to recruit

through the apprenticeship system have begun hiring university graduates instead, with the result that young Germans perceive a growing advantage of a university relative to a vocational credential (Bailey, 1995; Federal Institute for Vocational Training, 1994; Mickler, 1996; OECD: Germany, 1994; Steedman, 1993).[8]

As a result of these tensions, the Germans have introduced a number of reforms. One important change has been the dramatic reduction in the number of occupational categories. In 1987, 37 metalworking occupations were replaced by six with much broader profiles of responsibilities (Rauner, 1995). While in the past, "generally acknowledged vocational qualifications such as the master craftsman certificate [did] not have significance for admission to a technical college" (Reisse, 1992, p. 16), steps have now been taken to widen the recognition of vocational qualifications. Increasingly, young Germans are also entering universities after completing apprenticeships.

Vocational education reform in the ***Netherlands*** has assumed two primary objectives over the last several decades. Until the early 1980s, reform efforts were aimed at assuring educational equality and reducing the differences among vocational and general education. These efforts sought to give students ample opportunities to transfer within the system. At that time there was "a heavy emphasis on the principle that vocational education should not be a dead end and that it should offer students at least some of the same opportunities as general education" (Streumer, 1994, p. 5). With national economic difficulties arising in the mid- and late-1980s, however, the purpose of vocational education reform shifted toward developing a more effective workforce preparation mechanism in which the labor market could interact with the educational system to fulfill its labor needs.

At first glance, it appears that these two reform objectives actually work against each other. An industry focus places much of the onus of reform on vocational education to narrow its mission and become an instrument for the fulfillment of specific, sometimes narrow, industry training needs. On the other hand, an emphasis on establishing equality

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[8] Jeff King suggests a different view: "The problem is not that apprenticeships as a broad system of skills training and certifications are too unlike the professions and show no signs of ever becoming like them. Rather the problem is that the entire system is rapidly moving apprenticeships toward ever higher degrees of professionalism, and whether that may eliminate distinctions between apprenticeship trainees and college trained graduates to the extent that lower skilled and lower wage positions begin to lack formal training pathways linked to higher education."

between general and academic education means achieving some middle ground between broadly and narrowly defined educational missions. Many countries forced to deal with this conflict have opted for the former and concentrated on upgrading employment-related and job-specific skills, sometimes giving them a broader focus than vocational education formats have traditionally offered. In the Netherlands, the tensions between creating equality among educational paths and catering to industry needs have stimulated changes in *both* the vocational and general education systems. Vocational and general education have moved toward a more symmetric relationship as "complementary parts of a single coherent whole with a common purpose" (Streumer, 1994, p. 5).

New national skill standards and a unified qualification structure for vocational education have helped to bring vocational and academic education into a common framework. Efforts to broaden occupational credentials to meet industry needs began in the late 1980s and early 1990s when the Dutch government established a *qualificationnorm* representing the minimum vocational qualification that *every* Dutch resident must meet in order to function adequately in the labor market and modern society. Agreement was reached that courses in senior vocational secondary education and higher forms of general secondary education would be equal at the *starkwalificatie* or apprenticeship level, forcing changes at both the junior secondary vocational and lower general secondary levels of education (Van den Dool & Weijs, 1994, p. 6).

On-the-job training and the practical aspects of education have gained credence in upper-level general as well as vocational education, emphasizing not just the broadening of skills but the idea of "professional practice as part of the formal curriculum" (Van den Dool & Weijs, 1994, p. 7). Although it is likely that traditional institutional distinctions and hierarchical relationships between vocational and general education will persist in the Netherlands for some time, the gap is beginning to be bridged as university curricula have started to include work-related elements consistent with current labor market requirements. According to Van den Dool and Weijs, "there is a slow shift toward equality of status as the vocational element in university courses is strengthened and the vocational sector is increasingly seen to deliver courses leading to final qualifications of equal value with their university counterparts" (p. 1). A certificate from higher vocational education (HBO) now qualifies students to enter the university (Streumer, 1994).

In summary, it is apparent that standards and certification processes are important vehicles for systemwide reform and innovation in many OECD countries. There has been a general movement to consolidate the numbers of particular occupations for which credentials are awarded and to incorporate generic workplace skills into standards systems. But these changes can occur without challenging the distinction between vocational and academic streams of education.

In addition, a growing number of countries are developing vocational credentials that can serve as stepping stones to university and other forms of higher education. In Australia, the development of new vocational standards has influenced the content of traditional academic secondary school education. The advanced GVNQ appears to have become established as a viable route to higher education in England. Scotland is developing a unified secondary credential. Denmark, Germany, and the Netherlands have all opened more avenues to universities for holders of vocational qualifications. By combining vocational and academic content, new standards and credentials open students' options for both employment and continued education.

WORK-BASED LEARNING FOR STUDENTS

Because one hallmark of the emerging economy is the necessity for continual learning in the context of work, a logical implication for initial education and training is that schools should give young people some experience in work-based learning. By gaining practice in the deliberate use of work to develop knowledge and skills, young people should be better prepared for a lifetime of on-line learning at work. Some evidence that inclusion of worksite learning as part of initial education does have this effect is presented by Romani and Werquin (1995). They find that young people in France who have participated in work-based learning during their initial education are more likely to engage in continuing training as part of their subsequent employment. Romani and Werquin hypothesize that early participation in work-based learning may start a lifelong habit.

In addition to this possible future benefit, work-based learning has immediate advantages as an efficient method for acquiring knowledge and skill. Evidence on the cost-effectiveness of work-based compared to school-based training has already been mentioned

(Elias et al., 1994; Middleton et al., 1993). The educational benefit of work experience may also extend beyond the knowledge and skills that are strictly related to work (Berryman, 1995). As vocational and academic education converge, work-based learning may help students better understand abstract, theoretical ideas by applying them in concrete, practical situations.

The advantages of learning by doing have long been recognized, but lately the opportunity for young people to learn through regular employment has diminished in some countries. Payne (1994) describes the sudden, dramatic shift from work-based to school-based vocational training in the United Kingdom between 1988 and 1992. Sweet (1995) presents evidence of the recent decline in teenage employment in Australia. The recession of the 1990s pushed young people out of work in Sweden and France, as indicated in Figure 4 in the Appendices. In Denmark, the recession brought a shortage of places for apprentices in business enterprises.

Policymakers in many countries have responded to the contraction of youth employment and the perceived importance of productive experience by creating new mechanisms and incentives to promote work-based learning. These initiatives take two main forms: (1) classic apprenticeship or (2) work experience tied to schooling. The basic difference between the two is that classic apprenticeship treats trainees as members of the enterprise, giving them some of the rights and benefits of regular employees as well as some special entitlements. For example, German apprentices receive health and retirement benefits, benefit from special protection against firing, and receive special attention from their instructors (*meisters*). In contrast, young people who participate in work-based learning that is part of their schooling are still primarily students even though they may be paid for their part-time work.

A good example of a recent policy to reinvigorate classic apprenticeship is the initiative in the ***United Kingdom*** to create "modern apprenticeships" for 16- to 17-year-old school leavers. These youth receive government-funded training credits which they can cash in with employers who are able to provide the training required. Unlike traditional apprenticeships, these new arrangements will not require trainees to spend a fixed length of time in the enterprise. Instead, qualifications will be awarded when the apprentice has passed a set of performance-based requirements (the NVQs discussed in the previous section). Prototype programs were developed in 1994 in twelve sectors, including

agriculture and commercial horticulture, business administration, chemicals, child care, construction engineering, information technology, and retailing. When the new system is fully up and running, there are expected to be 150,000 apprentices in training (U.K. Employment Department, 1994). This number equals roughly 10% of the age group.

Other countries are also reviving traditional apprenticeship. ***Spain*** passed a new apprenticeship law in 1994 (Planas, 1995). In the ***Netherlands***, Streumer (1994) reports that the number of apprentices grew by 50% between 1986 and 1992. The government of ***Australia*** has announced plans to introduce a Modern Australian Apprenticeship and Training System, with many of the same features as the new U.K. system.

While some countries are expanding opportunities for work-based learning through classic apprenticeship, many other countries are developing new forms of work-based learning for students who do not receive the full rights and benefits of regular employees in the firms that train them. Most of the new efforts to develop youth apprenticeship in the United States, along with other forms of work-based learning encouraged by the 1994 School-to-Work Opportunities Act, belong in this category. Within this category of school-supervised work experience, some are attached to separate vocational programs, but others are connected with programs that combine vocational and academic instruction. Within the United States, cooperative education is still the most common form of work-based learning for high school students, and it is usually part of a vocational program (Stern et al., 1995). Most of the examples in other countries are also of this kind.

Korea, for example, restructured its three-year vocational high school curriculum in 1992 to include one full year in enterprises. This was intended to attract more students into vocational high schools, and to enhance their adaptability in actual work situations (Cho, 1994). Recent measures to expand the opportunities for vocational high school graduates to enter university also serve to enhance the attractiveness of the vocational program.

Similarly, ***France*** is making greater use of unpaid internships (*alternance*) for vocational students. This began on an extensive scale with the introduction of the vocational secondary diploma (*bac professionnel*) in 1985, followed by a 1989 law that required students enrolled for vocational or technical diplomas to spend some time in workplaces. For the vocational diploma, the requirement is at least 16 weeks in enterprises

during the two-year program. However, "The difficulty was to convince the companies, given that they would not be . . . [the ones to initiate] this *alternance*, which is tied to the needs of training rather than employment" (OECD, 1994, p. 118). Nonetheless, the fact that hundreds of thousands of vocational diploma students have in fact been placed in enterprises has encouraged the educational authorities in 1992 to extend the practice to the two-year vocational programs that start at age 15 and precede with the vocational diploma program. The university technical institutes are also in the process of adding a third year which will consist mainly of firm-based traineeships.

In ***Australia,*** where the proportion of students completing the last two years of secondary education has jumped from one-third to three-quarters in a decade, governments and private entities are working fast to augment the traditional academic curriculum with more practical applications. Sweet (1995) reports that the number of Australian students enrolled in courses with a centrally recognized work-based component tripled in one year, from 1993 to 1994. New "student traineeships" will allow students in years 11 and 12 "to combine their school-based studies with work experience and off the job training." The government expected to fund the purchase of off the job training "for up to 5000 students by 1995-96" (Keating, 1994, p. 93). Policymakers in ***Canada*** are also promoting expansion of work-based learning for high school students through cooperative education (de Broucker, 1995). In ***Sweden***, where upper secondary vocational education was extended from two to three years beginning in 1992, students in these school-based programs are now required to spend 15% of their time during those three years in work settings (Gustafsson & Madsén, 1995).

Sweet (1995) notes that work-based learning in Australia is sometimes used to enhance academic studies. Although this practice is growing, it is still unusual, as work-based learning has more commonly been used as a complement to vocational studies. Gustafsson and Madsén (1995) bemoan the fact that the 15% required work experience in Sweden is so far being attached only to vocational classes. Among countries that rely mainly on schools to provide vocational education, it is difficult to find examples of work-based learning tied to a curriculum that is explicitly designed to prepare students both for work and for further education. In the U.S., the 1994 School-to-Work Opportunities Act provided federal money for localities and states to design and implement new school-to-work systems in which work-based learning is a required component. Section 103 of the Act stipulated that work-based learning must be coordinated with school-based learning and

relevant to students' "career majors" (which integrate vocational and academic instruction and link secondary with postsecondary education). For example, career academies, which predated the 1994 Act, organize the high school academic curriculum around broad industry themes such as health, computers, or finance, and give students access to work in that industry during the summer and part-time during the year (Stern, Raby, & Dayton, 1992). Other examples in the United States are described by Pauly, Kopp, and Haimson (1995).

Most work-based learning for students takes place in business enterprises outside the school. Since the young people who participate are not regarded primarily as members of the enterprise but as students under the jurisdiction and supervision of the schools, the provision of work-based learning requires the formation of school-business partnerships or at least informal collaborative arrangements. Somehow school authorities and their business counterparts must decide on the general purposes and content of work-based learning; create or select training materials; establish routines for placing and supervising students; evaluate students' performances; agree on disciplinary procedures if necessary; and settle economic issues such as legal liability, transportation, and students' wages. None of this is easy because most educators and employers are unaccustomed to working with each other. Even if companies are accustomed to employing students part-time as in the United States (and increasingly in Australia, Spain, and the United Kingdom), this is quite different from organizing a work placement that serves a primarily educational purpose. For instance, work-based learning under the 1994 School-to-Work Opportunities Act was required to provide "instruction in general workplace competencies, including . . . employability and participative skills, and broad instruction, to the extent practicable, in all aspects of the industry." Bailey (1995) offers a discussion of these issues in the United States.

Even in Germany, despite the careful coordination of firm-based training regulations and school-based curriculum, Rauner (1995) and Koch (in OECD, 1994, p. 123) both criticize the lack of direct, ongoing coordination between the schools and firms that compose the dual system. The teachers responsible for instructing apprentices in vocational schools tend not to meet regularly or often with the apprentices' worksite supervisors, nor do they make regular or frequent visits to the workplace to see what

apprentices are doing. Consequently, they may not be able to refer in their classes to problems or situations that students are currently encountering at the worksite.[9]

School-Based Enterprise

As an alternative to work-based learning in enterprises outside the school, educational institutions also engage students in productive work under their own auspices. In the United States, for example, school-based enterprises traditionally attached to vocational education in high schools have performed such tasks as building houses or operating retail businesses. The 1994 School-to-Work Opportunities Act has recognized "school-sponsored enterprise" as a legitimate form of work-based learning. Students in school-based enterprises have reported that these promote learning more than the jobs they find on their own (Stern, Stone, Hopkins, McMillion, & Crain, 1994). A 1992 survey for the National Assessment of Vocational Education found that 19% of secondary schools in the United States were operating some kind of enterprise that involved students in producing goods or services for other people as part of their school activities (Stern, 1992b). Most of these were associated with vocational programs. For example, students in construction trades may build a house, those preparing for food service occupations may run a restaurant, classes in automotive trades often repairs cars, and a child care class may provide day care for clients outside the school. Similar activities take place in two-year colleges. These school-based enterprises are analogous to teaching hospitals run by medical schools or law review journals produced by law school students. The school enterprise provides practical experience that helps prepare students for subsequent work in a particular occupation or industry.[10]

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[9] Jeff King points out, nevertheless, that coordination between educators and employers "is, compared to non-dual system countries, known to be very deep and very comprehensive, from the national level, the state level, the unions, the Chambers which coordinate curricula and exams between schools and firms, the national, state, and regional employers associations, the national association of firms for qualification standards (Q-Verband), and a vast range of other formal and informal contacts and structures for coordination."

[10] Another type of school-sponsored enterprise is the student-owned business that is incubated in an entrepreneurship class. For example, REAL (Rural Entrepreneurship through Action Learning) is one organization in the United States that provides an entrepreneurship curriculum for helping students, primarily in rural areas, develop such enterprises which may then "graduate with the student" and become part of the local economic base. In contrast, the school-based enterprises described in the text are owned by the school and may continue to enroll students in succeeding years.

Denmark has recently expanded its use of school-based enterprise. First, "production high schools" were created as a training and employment mechanism for young people who were not in school. These are not part of the regular education or apprenticeship system but serve unemployed young people who have completed compulsory schooling without obtaining a vocational qualification. They combine instruction in vocational and academic subjects with production of substantial products—for example, furniture or clothing—for sale to the public (but avoiding unfair competition with commercial producers). As of 1992, there were 120 production high schools enrolling approximately 9,000 students (Danish Ministry of Education, 1994, p. 132). This represented roughly 5-10% of the 15- to 29-year-old age group.

When apprenticeship placements became scarce in the 1980s, Danish policymakers built on the precedent of the production high schools to create a new option within the regular apprenticeship system. Commercial and technical colleges were authorized to use school-sponsored enterprises to provide the work experience that would ordinarily be offered by nonschool enterprises (Danish Ministry of Education, 1994, p. 101; Østerlund, 1994). Printing, retailing, and construction are examples of the activities carried out by school enterprises. There are some indications that employers prefer to have trainees work in school-based enterprises rather than in the firm during the early part of their training, when they are less profitable for firms to hire as apprentices.

School enterprises can also be used to provide work-based learning for students who are not yet specializing in a particular occupation or industry. The Junior Achievement (JA) program in the U.S. is one of the oldest examples. Started in 1919, JA has involved millions of students in mini-enterprises, usually on an extracurricular basis but sometimes for course credit. JA is sponsored by the Chamber of Commerce, which recruits adult volunteers to serve as advisors and furnishes instructional materials. During one semester or year, students start up a company by raising equity capital (typically a few hundred dollars from relatives, friends, or their own savings), electing officers, and setting up accounts. They decide on a product—often a small gift item—then buy materials, produce the goods, and sell them. At the end, any profits are distributed among the stockholders.

The ***United Kingdom*** took mini-enterprises one step further. After an organization called Young Enterprise, modeled on JA, had taken up the idea as an extracurricular activity for students, the government in the 1980s promoted mini-enterprises

as part of the school curriculum, providing start-up funds, teacher training, and curriculum materials. By the late 1980s and early 1990s, approximately 40% of government-supported secondary schools were reporting that they sponsored mini-enterprises. These were seen as effective means for students to learn about work, for work, and through work (Jamieson, Miller, & Watts, 1988), though not to train for specific industries or occupations.

The ***German*** dual system, which epitomizes employer-based training, actually contains important elements of school-based enterprise, though they are seldom called that. Large German companies operate separate training facilities where apprentices spend much of their time, away from the regular productive operations of shops, offices, and laboratories. According to Koch, "Especially in large companies, training generally takes place outside the work processes and is largely carried out in training workshops, offices for practice, and classrooms" (OECD 1994, p. 122). Some small employers have also established inter-firm training centers for their apprentices at a different location than the firms' actual places of business. These training facilities and inter-firm centers may not be called schools, but in fact they are, although they are owned and controlled by employers or employer organizations. One might call them enterprise-based schools where the young trainees take classes and receive formal instruction. But the apprentices in large firms' training workshops also engage in productive activities that benefit the company—for example, producing parts for use in the main factory. The most appropriate term to describe such productive activity in these settings would be school-based enterprise within enterprise-based schools!

A particularly good example of school-based enterprise for the learning-based economy is a German-sponsored organization located in ***Singapore*** called the German-Singapore Institute (GSI). Founded in 1981 as a joint venture between the Economic Development Board of Singapore and the German Agency for Technical Cooperation, GSI calls itself a "teaching factory." It carries out applied development projects for local manufacturers, while preparing technicians and middle managers in the fields of advanced manufacturing technology, factory automation and robotics, plastics manufacturing technology, and (since 1992) manufacturing software. In 1994, GSI enrolled about 1,100 students and planned to grow to 2,000 students in the next six years. Students spend most of their two or three years in laboratories equipped with state-of-the-art production equipment, much of it donated by German manufacturers. In 1991, the German Machinery and Plant Manufacturers' Association gave GSI the German Mechanical Engineering

Award with a citation that commended GSI's "project-oriented approach to training within a comprehensive and practice-oriented environment." The GSI model has been emulated in Malaysia, Brazil, and elsewhere.

The capstone experience for students at GSI is the applied project in the last semester, which engages them in "production for learning." An Industrial Project Group (IPG) contracts with local companies and takes responsibility for meeting clients' cost, performance, and delivery requirements. The full-time engineers and designers in the IPG assign students to work on these undertakings, usually in groups of four to six. Projects may involve design and construction of automated manufacturing units, for example, to assemble or package electrical components. Students take responsibility for scheduling and organization, purchase of supplies, and cost calculation. Teamwork, problem solving, and creativity are emphasized.

GSI is organized in some ways more like a business than a school. Unlike most schools in Singapore, GSI teachers are not civil servants but are hired by the Employment Development Board and paid at the industry scale. Faculty and students work 44 hours a week. Instead of long holidays typical of an academic calendar, they receive only short vacations as in industry. The departments at GSI also have names that represent productive functions like tool and die making, design, and data processing, rather than academic disciplines.

In the emerging economy where production intertwines with on-line learning, the dichotomy that has divided education and schooling from work and productive enterprise has begun to break down. Integration of vocational and academic curriculum, active pedagogy that treats students as "knowledge workers," and work-based learning in enterprises inside or outside the school all blur the conventional boundary between education and work. These policy initiatives are logical responses to the recognition that productive knowledge is increasingly evanescent. Although education always will include some rote memorization and abstract exercises, and work will always include some following of orders from supervisors or clients, these no longer suffice. More than in the past, education for work must prepare a person to ask good questions and use good judgment in a practical context.

GOVERNANCE

Effective school-to-work programs require partnerships between educators and employers. As noted throughout this paper, the apparent success of school-to-work systems in the German-speaking countries seems to be associated with the exceptional degree of responsibility that employers have taken for the education and training of young people, which necessitates close collaboration with educational authorities in planning, implementing, and monitoring apprenticeships (Hamilton, 1990; Soskice, 1994). This collaboration in education and training is part of a larger set of joint decision-making relationships between governments and representatives of business and labor, often called the "social partners." This joint decision-making influences wage determination, health and retirement benefits, unemployment programs, and other social issues.

In other nations on the European continent, employers traditionally have not participated in the education and training of young people to the same degree as in the German-speaking countries, but the tradition of centralized decision-making between government and the social partners does exist. As described in previous sections, many of these countries have adopted policies to increase employer involvement in education and training. The existence of centralized decision-making with the social partners facilitates the adoption and implementation of these policies. The examples of Denmark and the Netherlands will be described in this section.

The English-speaking countries generally lack both the tradition of major employer participation in the education and training of young people and the tradition of strong centralized decision-making between the government and the social partners. When governments in these countries seek to increase employer involvement in youth education and training, the absence of a forum for joint decision-making with the social partners makes the adoption and implementation of such policies relatively difficult. Recent experiences in the United Kingdom and Australia will be summarized in this section.

In ***Denmark***, vocational education reform carried out between 1989 and 1991[11] has created a governance structure based upon strong central and local cooperation, both

[11] The Vocational Education and Training Act and Law 210 for vocational schools and Law 211 for vocational education and training were passed between 1989 and 1991 to replace the 1956 Apprenticeship Act and the 1977 EFG Act on Basic Vocational Education (OECD, 1994).

formal and informal, between education and labor market constituencies (Østerlund, 1994). The social partners have such a "strong comprehensive influence . . . [that] no important decisions are made without their participation" (OECD: Denmark, 1994, pp. 7, 18). The social partners are represented on committees that function on local and national levels to develop and maintain vocational schooling and in-company training courses, and establish recognized certification in vocational training and education programs.

The Federal Ministry of Education sets the overall, general objectives and rules for the content and financing of vocational courses based upon recommendations from its social partner advisory board, the Vocational and Training Council, comprised of representatives appointed by the Danish Confederation of Trade Unions and the Employers' Confederation. It advises the Ministry on issues such as the objectives and structures of courses, approval of new courses, program analysis, research and development, the general qualification of teachers, and student entry requirements. The Ministry's orders are then carried out by its executive body, the Department of Vocational Education and Training.

National Trade Committees, formed by industry associations and labor unions, are responsible for formulating the technical objectives and qualification descriptions for vocational education; assuring that curriculum, standards, and assessment meet current labor market needs; and setting up the rules for the practical in-company component of training (Jenkins, 1995; Østerlund, 1994). Although they are clearly the vocational arm of the training process, trade committees have "acquired a great deal of influence over the school portion of vocational education and training" and now provide input into the duration, structure, contents, and targets of courses in basic subjects, trainee periods, placement, and testing (OECD: Denmark, 1994, p. 9). Unlike many countries where industry groups take on a policy advisory mode, trade committees in Denmark "play a central role in governance of technical colleges where the in-school portion of vocational education takes place" by getting involved in the specifics of curriculum development and reducing the proliferation and overspecialization once found in technical education programs (Jenkins, 1995, p. 2).

Local Education and Training Committees, made up of local employers, employees, and educators, are appointed by the National Trade Committees to advise schools, promote cooperation between education and labor market participants, and assure that training meets

current local standards. With Danish reform efforts emphasizing a decentralized vocational system, Local School Governing Boards, using input from local education and training committees, have almost exclusive freedom for planning, curriculum, and financial management of vocational programs. All detailed educational planning and execution, once a federal responsibility of the Ministry of Education, has been assigned to the local level. Consistent with current reform policy, membership on local school governing boards is divided equally among Danish social partners.

The existence of these deliberative and joint decision-making bodies at various levels has helped to create consensus about the direction of education and training, and to carry it out. The result, as described in previous sections, is that the Danish system has evolved toward a flexible web of interconnected programs, allowing students to move back and forth between vocational and academic pathways.

Vocational education reform in the ***Netherlands*** has also relied extensively on governance from "national tripartite bodies" comprised of representatives from industry and vocational education. These National Bodies for Vocational Education develop occupational profiles and translate these profiles into elements of competence in secondary vocational education. They constitute an important link between industry, the government, and educational institutions having primary responsibility for the realization of a single qualification system for both the MBO (upper secondary education) and the apprenticeship system (Streumer, 1994; Van den Dool & Weijs, 1994). Reforms under this structure have been successful in integrating secondary vocational education into four main sectors (technical, administrative, service, and agricultural), merging educational institutions into larger entities, and decentralizing vocational administration to make education more effective and efficient in meeting industry needs (OECD: Netherlands, 1992).

The initiatives taking place in the Netherlands include closer linkages between vocational educators and industry, particularly between local companies who offer student internships and serve on or administer advisory boards and vocational schools. Not only are senior secondary and higher vocational education teachers offered internships to upgrade their skills and facilitate the implementation of new industry techniques in the school, but company employees are encouraged to serve as visiting or practical teachers to offer current vocational knowledge and teach new skills and aptitudes applicable to vocational practice (Streumer, 1994). There is also evidence of strong instructional

cooperation and communication emerging between vocational schools and companies in efforts to adapt curriculum to current career pathways in the local labor markets.

Especially notable in the Netherlands is the involvement of educators from both vocational and general education at secondary and higher levels in developing a new, more unified, vocational qualification system (Streumer, 1994). Although national focus has remained on the development of intermediate workforce skills, there is an increasing emphasis on workforce preparation in all levels in the educational community—even the college level. The government has supported institutional integration at higher vocational education levels by fusing "colleges providing only full-time courses with those delivering the school-based element of apprenticeship courses [in the hope that] bringing these different learning routes under the same roof could give an impetus to innovation on both sides" (Van den Dool & Weijs, 1994, p. 4). Not only has there been growth in the number of vocational courses offered throughout the entire system but a movement toward more occupational practice in the vocational courses themselves. Many lower level general education courses have added a career exploration component (Van den Dool & Weijs, 1994). Likewise, many universities have strengthened the vocational elements within their initial courses by adding internships and practical assignments—up to 10% of the first phase of schooling (Streumer, 1994).

Although both vocational and academic educators appear to be working toward similar goals by including vocational components in both of their curriculums, there is little solid evidence to indicate that they are doing this together in any sort of unified forum. While vocational and general educators both appear to be working more closely with industry, they are not necessarily cooperating with each other. This is similar to the situation in Denmark where there is direct collaboration between vocational educators and industry but the cooperation between vocational and academic educators is more indirect.

The ***United Kingdom*** has attempted in various ways to involve educators and employers in joint governance of education and training. Since the early 1980s, several industry-based efforts have dominated the development of occupational standards in England. In particular, the government delegated the task of identifying specific standards of competence required for particular occupations and jobs to the Industry Lead Bodies. These bodies were mostly made up of employers and sponsored by the Department of Employment. A 1981 white paper, "A New Training Initiative: A Programme for Action,"

issued by the government, highlighted the key role that education must take in training. The paper promoted occupational and academic integration by stating that ". . . the basic concept of providing a foundation of skills and knowledge by a combination of off the job training, classroom teaching, and work experience is as relevant as ever" (OECD: United Kingdom, 1994).

The National Council for Vocational Qualification (NCVQ) was established in 1986 to rectify the lack of consistency among existing standards and confusion among employers regarding the value of different levels and qualifications developed by various industry-awarding bodies. NCVQ was given responsibility for setting up a unified framework for vocational qualifications as well as overseeing and coordinating the standards set by industry associations and awarding bodies (Payne, 1994). Their framework formed the basis for National Vocational Qualifications (NVQs), which are primarily, but not exclusively, intended to assess the work-based performance of employees of all ages.

The NVQs are specifically designed to be independent of any educational system or program. This has the advantage of allowing certification for workers who learned their skills informally or in a program that is not attached to a particular certification scheme. The approach is designed to put certification and training squarely in the hands of employers (OECD: United Kingdom, 1994). While educators have begun to develop curricula around the NVQs, they have so far played a relatively minor role. One of the emerging problems with the NVQ system though is that the private sector has had less training capacity than had been expected. Thus, while there was substantial employer involvement in the process of defining the NVQs as skill standards, educators are playing a much greater role in the delivery of training (Vickers, 1995b).

In contrast to the NVQs, the new vocational secondary degree—the General National Vocational Qualification (GNVQ)—is school-based. In this case, there appears to be a growing collaboration between vocational and general (or academic) teachers, although up to this point, employers take a decidedly secondary role in this system (OECD: United Kingdom, 1994). Thus, the NVQ system is primarily employer-based with a minimal role for educators, while the GNVQ system has made progress on integrating vocational and academic education with much less involvement from employers.

The implementation of the Scottish Vocational Qualification (SVQ) system appears to have achieved a more balanced partnership between the education system and the private sector than its English counterpart. Vocational education in ***Scotland*** is regulated by the Scottish Vocational Education Council (SCOTVEC), an independent entity created in 1985. SCOTVEC runs vocational and technical education and training and works with both the employers and Further Education Colleges. SCOTVEC was developed by consolidating the Scottish Business Education Council (SCOTBEC) and the Scottish Technical Education Council (SCOTEC) and works as a private company under the general oversight of the Scottish Secretary of State to develop and promote vocational education and training as a national policy. SCOTVEC has the authority to develop and accredit courses and modules, award certificates (including SVQs), and approve alternative training providers.

When the SVQ system was established in 1986, it was built on the previously existing Scottish Action Plan which was developed in the early 1980s. The Scottish Action Plan developed a set of modules leading to a National Certificate (NC). Modules required approval by SCOTVEC, and any organization could teach them as long as it achieved SCOTVEC approval. In practice, employers and educators worked together to define skill standards, and the Further Education Colleges developed curricula to teach the NC modules. Thus, educators have been intensively involved with the SVQ system since its inception. In a system where educational institutions already had a stronger role, SVQ reforms created a more even balance of influence by strengthening the role of employers (Vickers, 1995b).

Also in contrast to the situation in England, the General Scottish Vocational Qualification (GSVQ) is closely related to the SVQs. In England, there is relatively less interaction between the NVQ and GNVQ systems. Things are different in Scotland because both SVQ and GSVQ systems emerged from the NC system developed by the Scottish Action Plan (OECD: Scotland, 1994). Thus, the developments in Scotland have brought together employers with both vocational and academic educators.

Australia's vocational reform has been successful in developing a strong national framework, based on national industry competence standards, for involving industry representatives in the governance of vocational education (OECD: Australia, 1994). In some fields, especially metalworking, automotive, and tourism and hospitality, employer input to the development of competency-based standards has been strong, as has support

for implementation. However, the level of support is not consistent across industries. As in Denmark, there is overt cooperation between vocational educators and employers, but less obvious cooperation between vocational and academic educators.

The Federal Government has assumed an important role in promoting national consistency across the country's training systems as well as redefining traditional roles and relationships (OECD: Australia, 1994). The national Australian Standards Framework (ASF) is the primary vehicle for industry participation centering around competency standards established by each industry (Noonan, 1994). By the end of 1994, standards endorsed by the National Training Board covered more than half of the Australian workforce. Under the National Framework for Recognition of Training (NFROT), states and territories register training providers and validate industry-developed assessment and certification mechanisms. Training providers may be TAFE colleges, accredited firms, or private-sector training vendors. Within the NFROT framework, states and territories take responsibility for the recognition of accredited courses, for funding the provision of training programs, and for awarding credentials for vocational training (OECD: Australia, 1992).

New pay structures favoring broadly based, multiskilled workers led, in tandem with the industry standards being developed, to joint education and labor participation in MOVEET (the Ministry for Vocational Education, Employment, and Training). This new Ministerial Council involves "ranges of Commonwealth and State officials and key industry people who were committed to a common agenda involving both a more industry driven and responsive system and the need for these reforms to be undertaken on a nationally consistent basis" (Noonan, 1994, p. 13). In past governance structures, State and Federal Ministerial Council members, in charge of industrial relations and labor issues, worked separately from Ministers who were responsible for the more educational aspects of the TAFE system. In contrast, the new merged system allows "industrial relations, training and industry issues to be considered in an integrated way" (p. 13).

Securing the participation of private sector employers in Australia has not been easy, although some firms and sectors such as Qantas, the automobile industry, and the hospitality and tourism industries have been very much involved with training. Thus, as Goozee (1995) points out, "At present, the capacity of employers and their willingness to participate in the system is largely untested and uneven where it does exist" (p. 119). Given

the convoluted structure of state and national employer associations in Australia,[12] the country lacks a unified voice for employers. This has created marked differences and fragmentation among employers regarding current vocational reform issues such as "the future of the apprenticeship system, the importance of enterprise-based training models for young people, the role of national standards and the conditions under which structured training should be extended" (Sweet, 1993, p. 3).

Although vocational educators are involved in vocational reform at the national level, educators at the local level are not always committed to the Australian Vocational Education and Training (VET) reform agenda which "commands wide support among Commonwealth, State and Territory Governments, employers, and unions" (OECD: Australia, 1992, p. 4). Reported observations of union and employer representatives indicate a lack of educational integration leading to "total bewilderment that is the common reaction of classroom teachers to the reform process . . . [and] complaints from teachers that the agenda is a top down one in which they have no involvement" (Sweet, 1993, p. 1). On the other hand, some of this resentment may be accounted for by the rapid pace of change that the Australian educational system has experienced in the last few years.

In sum, Australia has achieved a significant reform of its vocational education governance structure. National-level government officials, educators, union representatives, and employers have devised more cooperative procedures. Still, more work will be necessary to gain the full participation of the more academically oriented teachers and local-level employers and educators.

All of these countries have worked to forge partnerships between employers and vocational and academic educators. Securing the full participation and cooperation of academic educators in these reforms has received much less attention than the participation of employers. In many cases, the developments that we have been discussing are seen as reforms of the vocational education system. The Netherlands is an interesting case in which attempts have been made to strengthen this aspect of the governance structure. One result is

[12] Australia has three or four primary national employer bodies "depending on how you define them" and about eighty secondary bodies with variable overlap between the two. Several hundred state employer associations exist (Sweet, 1993).

that the reforms have started to influence the content of the academic as well as the vocational streams.

CONCLUSION

The emergence of a more learning-intensive economy has begun to change the relationship between education and work. As employers try to promote on-line learning and people move more frequently from one job to another, continual learning at work becomes increasingly important.

Four main elements characterize an education system that is likely to prepare students effectively for this new environment. Three of these elements—(1) skill standards, (2) workplace learning, and (3) strong links between employers and schools—are evident in countries where school-to-work systems have worked well in the past. Accordingly, countries with less successful systems have been introducing reforms that incorporate these features.

But these elements are no longer sufficient. In addition, most countries have also found it necessary to create a closer connection between vocational and academic education because neither traditional form of education by itself is likely to meet the requirements of learning-intensive work. To prepare for continuous change, school-to-work systems are now called upon to equip students both with the abstract theory and analytical skill that the academic curriculum has traditionally tried to teach and the knack for practical application that has been a hallmark of vocational education. Employer involvement, skill standards, and work-based education are reflecting this new policy direction to varying degrees in different countries.

In some countries, the merging of vocational and academic streams has been occurring through upgrading the academic content of studies within vocational institutions or programs. For example, in Germany, the dual system of occupational education brings the average apprentice to a relatively high level of theoretical understanding, and training standards are constantly being revised and upgraded. In France and Sweden, vocational education takes place mainly in schools, unlike Germany where employers themselves do

most of the training. But in France and Sweden, as in Germany, the integration of occupational and academic education has occurred mainly by adding more academic content to vocational programs.

By contrast, Britain and Japan have recently created new curricular options that are not confined to vocational institutions. These new curricula use occupational or industry related themes as a focus for organizing the study of academic subjects. In Britain, and also in Australia, the new integrated programs are supported by new performance standards, work-based learning, and greater participation of employers.

In all these countries, one explicit purpose of linking vocational with academic education is to make it easier for vocational graduates to continue their education at a university or other postsecondary institution. Students who enter the workforce immediately after leaving one of these integrated programs still retain the option of continuing their education later. Conversely, those who proceed directly to higher education have the option to change their minds and enter the workforce. The integrated or upgraded vocational program thus prepares individuals for both work and continued learning, allowing easier movement from one to the other.

The findings of this report are encouraging for the United States, where local communities, states, and the federal government have been spurred by continuing criticism to undertake major changes in the institutions that usher young people from education to employment. Although the evidence about youth unemployment in this report suggests that the United States does not, in fact, have the least effective school-to-work system in the industrialized world, it has not been the most effective either. Most American 20-year-olds probably have not achieved either the mastery of academic subject matter or the level of occupational proficiency attained by their counterparts in Germany, for example. But in the United States, where control of education and training is more decentralized than in most other countries, many localities have launched initiatives that are preparing young people for college and careers at the same time (Business Week, 1996). There is evidence that these initiatives are raising achievement levels (Stern et al., 1995). The main cause for optimism in the United States is that the recent reforms taking shape in some American schools and communities—combining an occupational and academic curriculum with work-based learning and high standards for all students—appear likely to provide the best preparation for young people entering an economy where learning and work are

increasingly intertwined. The fact that most other industrialized countries either have been moving in this direction for some time or are now beginning to do so corroborates the logic of these efforts.

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APPENDICES

Figure 1
Unemployment Rates for Youth and Adults - 1979

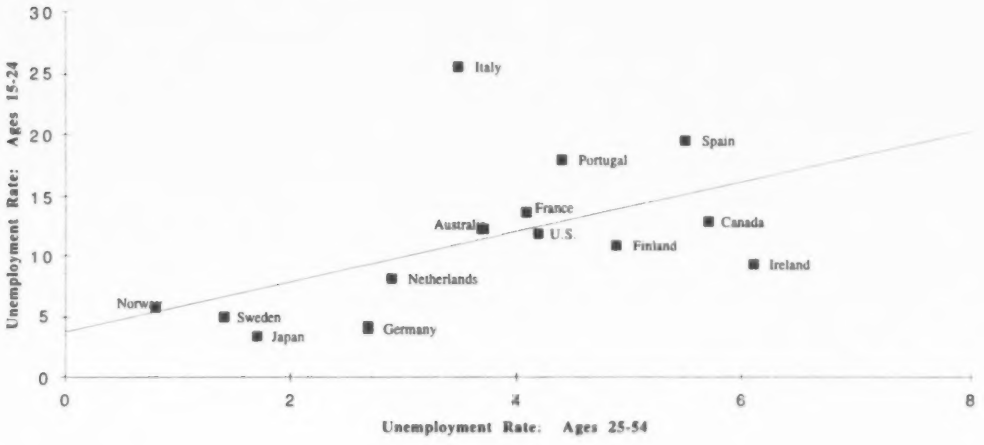


Figure 2
Unemployment Rates for Youth and Adults - 1983

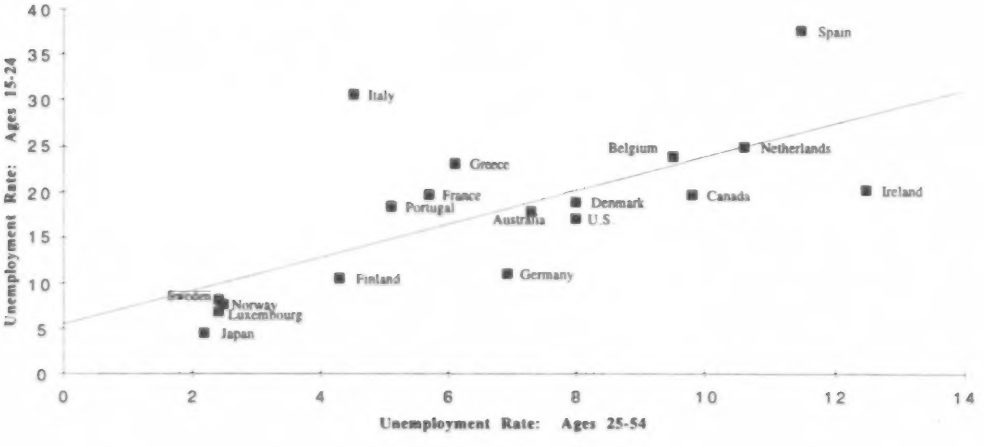


Figure 3
Unemployment Rates for Youth and Adults - 1990

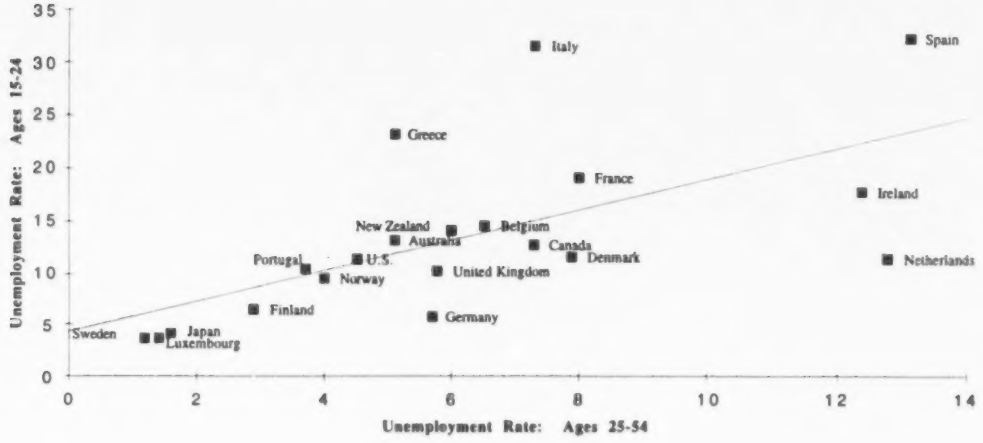
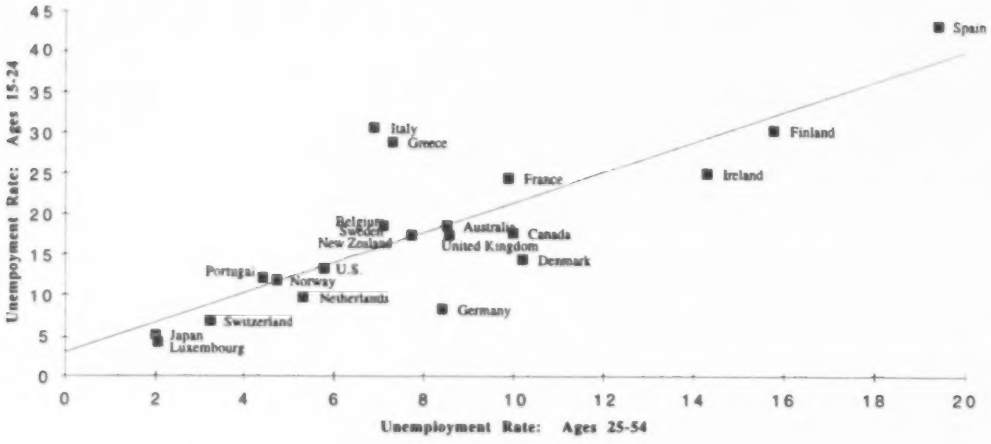


Figure 4
Unemployment Rates for Youth and Adults - 1993



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